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AUTHOR Mathes, J. C., Comp.; Pinelli, Thomas E., Comp.
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ABSTRACT

This compilation of papers addresses the history, present status, and trends of technical and related writing. The first of the eight papers surveys the present environment of the technical report and assesses the effectiveness of the technical report format of the National Aeronautics and Space Administration (NASA) in transmitting information. The second paper examines the technical writing teacher's responsibility in teaching the problems faced by professional engineers, while the third paper explores scientific writing from its beginnings in the seventeenth century until approximately 1815. The fourth paper defines technical communication in an empirical way and discusses the implications of technical communication for a humanistic education in a technological age. The fifth paper considers ways in which writers are involved in the prevention and defense of product liability actions. The sixth paper examines how an interview model could facilitate communication, and the seventh paper relates how an English teacher might become a writing consultant. The final paper discusses the need for technical writers to assume responsibility for their reports. (HOD)

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Technical Writing: Past, Present, and Future

Compiled by
J. C. Mathes
University of Michigan
Ann Arbor, Michigan

Thomas E. Pinelli
NASA Langley Research Center
Hampton, Virginia

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NASA
National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia 23665

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MARKETING INFORMATION: THE TECHNICAL REPORT AS PRODUCT

Dr. Freda F. Stohrer, Assistant Professor
Department of English
Old Dominion University
Norfolk, Virginia 23508

and

Thomas E. Pinelli, Assistant Chief
Scientific and Technical Information Programs Division
NASA Langley Research Center
Hampton, Virginia 23665

ABSTRACT

For many R&D agencies of the federal government, including the National Aeronautics and Space Administration (NASA), the technical report constitutes a product, the primary means for communicating the results of their research to the user. The present environment of the technical report is vast, with considerable variance in report components, format, and organization. As part of the Langley scientific and technical information (STI) review and evaluation project, a review of the technical report as an effective product for information communication was undertaken. Style manuals describing theory and practice in technical report preparation; publication manuals covering such factors as design, layout, and type style; and copies of technical reports were obtained from industrial, academic, governmental, and research organizations. Based on an analysis of this material, criteria will be established for the report components, for the relationship of the components within the report context, and for the overall report organization. The criteria will be used as as bench marks and compared with the publication standards currently used to prepare NASA technical reports. The comparison may reveal changes which can be made to the existing NASA standards to improve the effectiveness of NASA's technical reports as products for information communication.

INTRODUCTION

The research and development (R&D) expansion, which began during World War II, resulted in significant changes in scientific and technical information (STI) activities in the United States. These changes, which were necessary to handle the increased production of STI, included new methods of publishing, disseminating, storing, and retrieving scientific and technical information. A significant change occurred in the way in which the results of research were published. During this period, the distribution of R&D activities changed from a

complete reliance on traditional journals and monographs to the widespread use of the technical report (Adkinson, 1978).

Growth of Technical Report Literature

The technical report has also been used by industry to communicate significant and complete research results. Due primarily to the federal government's support of R&D activities and the associated need to record the progress and document the results of government-sponsored research, the volume of technical report literature has grown steadily. Approximately 15,000 technical reports were produced in 1965. A decade later, in 1975, the yearly total exceeded 60,000 reports. The projected production for 1980 was established at 80,000 reports (King, 1977). The number of U.S. scientific and technical literature items by medium is shown in Table A.

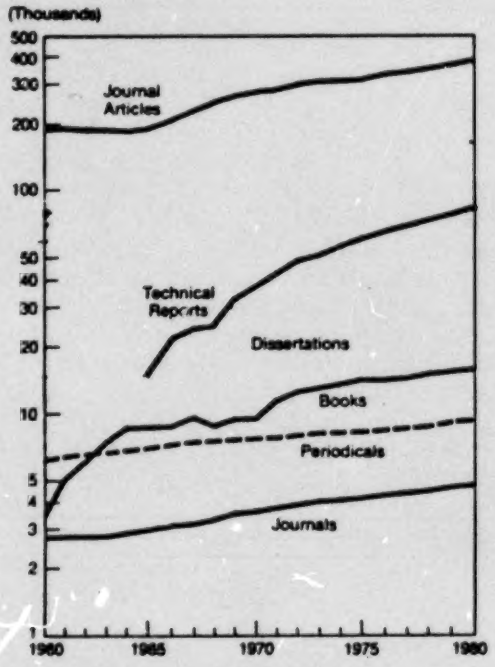

Table A.- Number of U.S. S&T literature items by medium (1960-1980).

For calendar year 1980, the National Aeronautics and Space Administration published 3,399 technical reports. Like many R&D agencies in the federal government, NASA regards the technical report as a product, the primary means of communicating research results to the user. As a primary means of communicating

technical information, NASA technical reports must be organized and written to accomplish the most effective communication of its contents.

NASA technical reports are processed into the NASA scientific and technical information system where they are distributed to industrial, academic, and public organizations; accessioned into RECON, NASA's computerized bibliographic data base; and indexed and abstracted in STAR, NASA's announcement publication for technical report literature. The NASA technical publications which are available for sale to the public can be obtained from the National Technical Information Service (NTIS) in Springfield, Virginia.

The National Technical Information Service was established as part of the Department of Commerce to simplify and improve public access to scientific and technical reports produced by federal agencies and their contractors. NASA technical reports, as well as those of other federal R&D agencies, are added to the NTIS data base. The NTIS data base may be searched through such commercial data bases as SDC's ORBIT III, Lockheed/DIALOG, and BRS.

Technical Report as Product

The technical report is a tangible product of a research effort. Although agreement exists that these reports should be organized, clearly worded, and easy to use, report producers disagree on (1) the definition of the technical report, (2) the role of the technical report in the scientific and technical environment, and (3) the arrangement of the parts of the technical report.

The definition of the technical report varies because it serves different roles in communication within and between organizations. The technical report can be defined etymologically, according to the derivation of "report" (Weisman, 1966); descriptively, according to the report content and method (DoD, 1964); behaviorally, according to the influence on the reader (Ronco, 1965); and rhetorically, according to the function of the report within a system for communicating scientific and technical information (Mathes and Stevenson, 1977).

In 1968, COSATI (Committee on Scientific and Technical Information) assembled a task group which appraised the role of the technical report in the scientific and engineering communication process. The technical report was found to be the primary recording medium for applied research and thus favored

by the technologists. The technologists saw great merit in a number of features of the technical report including 1) timeliness, 2) comprehensive treatment, 3) inclusion of ancillary information, and 4) the frequent inclusion of negative results. On the other hand, the COSATI study found that scientists questioned the reliability of the technical report because of its allegedly unreviewed nature and its availability in terms of access through a retrieval or archival system.

Publications manuals representing a cross-section of the scientific and technical community were examined in an attempt to discover a standard arrangement of components recommended for inclusion in a technical report. There was little agreement about the inclusion or the arrangement of components. The matrix illustrating the variety in these documents is included as an appendix.

STATEMENT OF THE PROBLEM

In February 1980, the Scientific and Technical Information Programs Division undertook the first comprehensive review and evaluation of the Center's STI program. As part of the project, a study of the technical report was undertaken to determine whether the NASA publication standards of style and organization made the technical report an effective product for transmitting information.

Purpose of the Study

NASA employs uniform publication standards designed to ensure the clarity, quality, and utility of its technical reports. These standards were designed to produce reports of maximum readability and ease of comprehension, written in a style that is both logical and familiar because of its wide acceptance in technical writing. However, an evaluation of NASA publication standards had never been conducted.

Importance of the Study

A survey of the literature disclosed that little, if any, documented research existed to support or suggest criteria for assessing the effectiveness of a technical report. Consequently, a survey to establish the present environment of the technical report and to produce empirical data against which NASA publication standards could be compared was deemed essential. This paper reports the preliminary findings of the study.

RESEARCH METHODOLOGY AND PROCEDURE

The study utilized survey research to obtain input from organizations which were known to produce technical information. Addresses were compiled from two sources: the Society for Technical Communication (STC) membership and NASA's distribution list for technical reports. The study was conducted in conjunction with the firm of Graffic Traffic Studios, located in Norfolk, Virginia.

Limitations of the Study

For purposes of this study, the technical report was defined as a communication product designed to convey the comprehensive results of basic and applied research together with the ancillary information necessary for interpretation, replication, or application of the results or techniques. The study was limited to those technical reports which recorded significant scientific or technical accomplishments and which were specifically prepared for distribution outside of the originating organization. Thus, in-house memo/letter reports, the corporate "proposal", institutional reports such as periodic reports or annual reports, and the contract progress report were eliminated.

Procedure

A letter was sent to individuals representing 611 organizations in industry; academia; government; and research, trade, and professional associations. The individuals were asked to provide the following:

1. Copies of typical reports published by their organizations;

2. A copy of their style manual or the name of the commercially prepared manual (e.g., Chicago Manual of Style) if one is used;

3. A copy of the publications or graphics manual or standards covering such factors as design, layout, typography style, illustrative material, printing, binding; and

4. A form indicating the absence or presence of the requested information.

Approximately 200 pieces of literature were received from 124 organizations within the established time limits. Ninety-nine technical reports were suitable for analysis and data extraction. The data were analyzed according to established criteria. No statistical inferences were made from the findings.

FINDINGS

Of the 611 organizations contacted, 99 respondents sent material suitable for analysis and data extration. The overall rate of return for the survey was 16.3%.

Survey Response

The 99 responses were grouped according to organization. The largest group in the survey population was the industrial organizations; followed by the research, trade, and professional organizations; government organizations; and the academic organizations. This grouping is shown in Table B.

Organizational Type	Requests	Responses	Percent Responding	Percent of Total Survey
Government	49	12	26.6	12.2
Industrial	426	54	12.6	54.5
Academic	76	11	14.4	11.1
Research, Etc.	60	22	36.6	22.2
TOTALS	611	99	16.3	100.0

Table B. - Survey responses by organization

Components - Their Use and Location

The material was analyzed to produce an exhaustive list of report components. Ninety-eight report producers described structural components using 98 different terms. In compiling the list, those terms which appeared to describe components having the same function were grouped. An analysis of the frequency of usage of the components disclosed that only five components were used by 50% or more of the responding organizations (see Table C).

Next, the material was analyzed to determine the location of the components within the report. No standard sequence was discovered, because the components were located in almost every possible position within the report. No convention was discovered for describing the various sections of the technical report. Therefore, the three areas of traditional book publishing: front matter, body, and back matter were used to locate the components. (The front matter consists of all material preceding the main text. The body contains the investigative, analytical, or

theoretical material. The back matter consists of reference material and other supplementary matter.)

Five components (cover, title page, table of contents, Introduction, and Appendixes) were mentioned by 50% or more of the respondents. Only the cover and the table of contents were consistent in their location within the report. Less agreement existed about the location of the title pages, Introduction, or Appendixes.

The components in the exhaustive listing were refined so that they could be compared more easily with the components covered by the NASA Publications Manual. Components which appeared to have the same function were combined. For example, "List of Drawings" was combined with "List of Figures." Any component mentioned by NASA was included. The number of components was reduced by eliminating any component used by fewer than five report producers.

The components derived from the exhaustive list were compared with the components and their recommended placement as specified in the NASA Publications Manual. The components and their placement as specified by NASA compared favorably to those contained in the refined list. The analysis did reveal variations in the number and placement of front matter components. Where body components were concerned, NASA placed the same elements in the body of the report as those contained in the refined list. A comparison of back matter components revealed certain variations, most notable in the placement of the glossary and index.

A breakdown of the five components, the percentage of use, and their location within the report is presented in Table C.

Component	%Use	Front	Body	Back
Cover	67.6	100.0	---	---
Title Page	80.0	96.2	2.5	1.2
Table of Contents	70.7	100.0	---	---
Introduction	57.5	17.5	82.4	---
Appendixes	59.5	---	1.6	98.3

Table C.- Components by use and location

Use of Style Manuals and Publication Guides

The respondents were asked to provide information relative to the use/non-use of style manuals and publication/production guides. Respondents were also

asked to identify the use of commercially prepared style manuals. The responses were compiled and are presented in Table D. While the chart is phrased in use/non-use terms, mutually exclusive categories were not specified. Therefore, the percentages cannot be added to describe 100% of the sample.

	Chicago	AP	GPO	*Other Commercially Available Style Guide	Your Organization's Own Style Guide	No Style Guide Used	Publication/Production Guide	Do Not Use Publication/Production Guide
Government	16.6	16.6	83.3	33.3	41.6	25.0	58.3	41.6
Industrial	31.4	5.5	42.5	27.7	29.6	37.0	33.3	46.2
Academic	54.5	27.2	27.2	36.3	18.1	45.4	54.5	54.5
Research, Etc.	59.0	13.6	50.0	27.2	31.8	31.8	40.9	50.0
Total Survey Average	38.3	11.1	47.4	29.2	30.3	35.3	40.4	41.6

*DeBakey, The Scientific Journal: Editorial Policies and Practices (Mosby, 1976); NASA Publications Manual; NASA SP-7013; NBS Communications Manual; Abbreviation and Symbol Guide; New York Times; Reisman's Style Manual for Technical Writers and Editors; "Guidelines to Format Standards--COSATI;" STC Typing Guide for Math; American Psychological Association; Editorial Manual of the AMA; The Elements of Style; Strunk & White; Handbook of Current English; Words Into Type; CBE Style Manual; Council of Biology Editors Style Manual; Turabian: Manual for Writers; ANSI/IEEE Std 260-1978; Geological Survey Style Manual; AIP Style Manual; ACS Style Manual; SMART Communications Inc.; MLA; Fowler; Baker; UPI Style Manual; National Education Assoc.; American Institute of Physics; Technical Manual Writing Handbook; Technical Writing Style Guide; Guide for Beginning Technical Editors; Math Into Type--Swanson; Handbook for Authors-American Chemistry Society.

Table D.- Use of style manuals and publication guides by organization

The majority of respondents relied upon a style manual to prepare technical reports; however, approximately 33% of the respondents used no style manual. The GPO manual was used by the majority (83.3%) of respondents from government operations. A majority of academic and research respondents, 54.5% and 59% respectively, used the Chicago Manual of Style in report preparation. Respondents were almost evenly divided in the use/non-use of a publication/production guide.

SUMMARY OF THE STUDY

The study represents an attempt to assess the NASA technical report as an effective medium for information transmittal. The evaluation included the compilation of empirical data through a survey of report producers and through a survey of report components, formats, and organization following a study of current style manuals.

A survey of the literature disclosed that little, if any, documented research existed to support or suggest criteria for assessing the effectiveness of a technical report. Consequently, a survey designed to determine the present environment of the technical report and to produce empirical data against which NASA publication standards for technical reports could be compared was deemed essential.

During the analysis of the findings of the study, wide variances in the technical report were discovered. Nearly one hundred components were identified, based on the extensive array of terms. An attempt to reduce the number of components was made by combining similar components under one heading and the elimination of seldom used component terms. No standard sequence was discovered for the components, so only a general location for them could be made in terms of front, body, and back matter.

FUTURE RESEARCH

Future research will be devoted to assessing the adequacy of the reduced set of components, clearly defining the purpose of each component, and developing evaluative criteria for each. The components of the NASA reports will be evaluated according to these criteria. Based on the tabulation of locations in common usage, alternate theoretical sequences of components will be developed and tested empirically. The NASA report will be tested against the sequence established by research.

CONCLUSIONS

The number of technical reports has increased steadily since the expansion of R&D activities began in the U.S. during World War II. The statistics compiled by Donald King for the National Science Foundation project the continued growth of this communication medium. For many R&D agencies of the federal

government, the technical report is their product, the primary means used to transmit the results of their research to the user. Viewing the technical report as product, agencies of the federal government have created the necessary systems for disseminating, storing, retrieving, and otherwise making this medium available to the scientific and technical community.

The work by COSATI represents a significant treatment of the role of the technical report in the total STI communication process. While the work by COSATI represents a definitive treatment of the technical report, it did not address how to make the technical report more effective in communicating information to the user. The COSATI report recognized the need for, but stopped short of recommending uniform standards designed to enhance clarity, quality, and maximum utility. Many organizations such as NASA have developed publication standards to ensure clarity, quality, and utility of their reports and to prescribe the inclusion and arrangement of the components. The review of the literature revealed that bench marks for evaluating some of the components have been established. However, no critical evaluation of existing publication standards has been undertaken.

The preliminary findings of the NASA study revealed that (1) nearly one hundred components were used, (2) there was an apparent lack of consistency in the terms used for the components, and (3) there was an apparent lack of consistency in the location of the components. Further analysis and review of existing publication standards should be undertaken. Criteria for existing report components should be integrated and synthesized to establish a uniform standard for those components. Evaluative criteria should be developed for those components for which no criteria exist. Depending upon the purpose of the report and the audience, a standard for including specific report components should be established. Next, the proper sequence of the components should be determined. An empirical testing of these standards should be undertaken to ascertain the most effective choice and arrangement of components for transmitting information to the user.

REFERENCES

Adkinson, Burton W. Two Centuries of Federal Information. Stroudsburg, Pa.: Dowden Hutchinson, and Ross, Inc., 1978, p. 29.

King, Donald W. A Chart Book of Indicators of Scientific and Technical Communication in the United States. Rockville, Md.: King Research Inc., December 1977 (prepared for National Science Foundation; available GPO 038-000-00360-7), p. 7.

Weisman, Herman M. Technical Report Writing. Columbus, Ohio: Charles W. Merrill Books, Inc., 1966.

Department of Defense. Glossary of Information Handling. (after a DoD subcommittee draft of January 1964), 1964.

Ronco, P. G. Characteristics of Technical Reports that Affect Reader Behavior: A Review of the Literature. Boston: Institute for Psychological Research, Tufts University, 1965 (prepared for National Science Foundation, available NTIS PB 169 409), p. 24.

Mathes, J. C. and Stevenson, Dwight W. Designing Technical Reports. Indianapolis: The Bobbs-Merrill Co., Inc., 1976, p. 3.

Committee on Scientific and Technical Information. The Role of the Technical Report in Scientific and Technological Communication. Washington, D.C.: Federal Council for Science and Technology, December 1968 (available NTIS PB 180 944), pps. 26-29.

APPENDIX. - COMPARISION OF SIX STYLE GUIDES FOR NUMBER AND ARRANGEMENT OF COMPONENTS

COSATI	U.S. GEOLOGICAL SURVEY	HOW TO WRITE AND PUBLISH A SCIENTIFIC ARTICLE	APA PUBLICATIONS MANUAL	NATIONAL ACADEMY OF SCIENCES	NASA PUBLICATION GUIDE
Front Cover	* * *	* * *	* * *	Cover	Cover (but not described)
* * *	* * *	* * *	* * *	[Half-title page]	* * *
* * *	* * *	* * *	Title	Frontispiece	* * *
Technical Report Standard Title Page	Title Page	Title		Title page	Technical report standard title page
(with parts: abstract, authors, etc.)	(with parts: title, author)		Author		(with abstract, title, authors)
* * *	* * *	List of authors and addresses	Author's institutional affiliation	* * *	* * *
* * *	* * *	* * *	* * *	* * *	* * *
* * *	Frontispiece	* * *	* * *	[Verso title page]	* * *
* * *	Foreword	* * *	* * *	* * *	* * *
* * *	Preface	* * *	* * *	Foreword	Foreword
Preface	* * *	* * *	* * *	Preface	Preface
* * *	* * *	* * *	* * *	Acknowledgements	* * *
* * *	* * *	* * *	* * *	[Committee of panel members]	* * *
* * *	Table of contents	* * *	* * *	Letter of transmittal	* * *
Table of contents	List of illustrations	* * *	* * *	Table of contents	Table of contents
List of illustrations	List of tables	* * *	* * *	* * *	* * *
List of tables	* * *	* * *	* * *	List of tables and figures	* * *
List of abbreviations and symbols	Glossary (signs and symbols)	Abstract	* * *	* * *	* * *
* * *	* * *	Introduction	Abstract	* * *	* * *
* * *	Abstract	Materials and methods	* * *	* * *	[First page of text]
Introduction	Beginning	* * *	* * *	* * *	Summary
Main text	Presentation of data	* * *	Introduction	Introduction	Introduction
Headings	Headings	* * *	Method	* * *	* * *
* * *	Footnotes	* * *	* * *	* * *	Symbols and units
Numbering systems	* * *	* * *		Body	Main Body
* * *	* * *	* * *	* * *		Headings
* * *	* * *	* * *		Headings	* * *
Conclusions	The end	Results	* * *	Footnotes	* * *
* * *	* * *	Discussion	* * *	* * *	* * *
* * *	* * *	* * *	* * *	* * *	Descriptive information
Recommendations	* * *	Literature cited	* * *	* * *	Mathematical presentation
Appendixes	Reference list	* * *	* * *	* * *	* * *
Glossary of terms	Appendix	* * *	Results	* * *	Results and discussion
References	* * *	Acknowledgements	Discussion	* * *	* * *
* * *	* * *	* * *	* * *	* * *	Concluding section
Index	Index	* * *	References	References and notes	* * *
Illustrations	Illustrations		* * *	Bibliographies	* * *
	Plates		Appendix	Appendixes	Appendixes
	Figures		* * *	* * *	References
	Captions		* * *	Glossaries	* * *
Tables	Tables	* * *	* * *	Indexes	* * *
Equations	* * *	* * *	Tables	Tabular and graphic material	Tables
Composition	* * *	* * *		Tables	
Workmanship	* * *	* * *		Illustrations	
				Half tones	
				Figure caption	
			Figures, graphs, illustrations	* * *	Figures
					Photographs
					Drawings
			* * *		Graphs
				Mathematics	* * *
				Symbols	
			* * *	Equations	
			* * *	* * *	Numbered items
			* * *	* * *	Makeup
			* * *	* * *	Page dimensions
					Typography

Note: *** asterisks indicate the absence of a particular component

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THE NATURE AND TREATMENT OF PROFESSIONAL ENGINEERING PROBLEMS: THE TECHNICAL WRITING TEACHER'S RESPONSIBILITY

Ben F. Barton, Professor
Department of Electrical and Computer Engineering
University of Michigan
Ann Arbor, Michigan 48109

and

Marthalee Barton, Lecturer
Department of Humanities
University of Michigan
Ann Arbor, Michigan 48109

INTRODUCTION

Rhetoric teachers often impute to engineering students a technical expertise in the treatment of problems addressed by professionals. This imputation has prompted two general pedagogical responses among technical communication instructors. The first response amounts to a denial of responsibility for assessing the professional caliber of a student's treatment of a technical problem. Technical issues are seen as the domain of the technical student, not of the rhetoric instructor. This particular version of territoriality is consistent with the historical emphasis in textbooks and pedagogical literature on mechanical, or formal, aspects of writing.[1] Moreover, these territorial bounds have not shifted greatly in recent years, even while pedagogical concern has broadened to encompass such issues as audience and purpose.[2]

The second pedagogical approach goes even further and turns a supposed defect--the rhetoric instructor's lack of technical expertise--into a virtue: The teacher and student interchange roles to allow an avid communication specialist to be instructed in the mysteries of the technical problem and its solution. Such deference to technical expertise has led to the suggestion that students "be asked to instruct the teacher."[3] Another call for role reversal is expressed thusly:

> "As teachers of technical writing, we cannot expect to be more knowledgeable in our students' subject area than they have a responsibility to be. Thus we can and should hold them responsible for actually educating us in their disciplines. The realization that they are expected to know more than the teacher who reads their work may be unnerving to some, but it may well be the most important education we can provide them."[4]

Such deference to student technical expertise is disturbing for two reasons. First, the belief that the student is more knowledgeable is valid only on one level--the level of subject matter, or of surface textualization of the technical materials. At a more meaningful level--the level of deep, or paradigmatic, structure--the student is often <u>not</u> an expert and the rhetoric instructor <u>can</u>, and <u>should</u>, be. Second, the undifferentiated belief in the student's technical expertise leads, in our view, to an unfortunate emphasis on the <u>tutorial</u> approach to problems. Such emphasis may address the needs of an overwhelmed rhetoric teacher but does not address the central problem of the student attempting to simulate professional performance. In fact, the crux of the student's problem is to distinguish the tutorial treatments of textbook problems, which dominate classroom experience, from the profoundly different professional treatments of problems typically addressed by engineers. A pedagogy based on reversal of educational roles thus reinforces the commitment to tutorial treatments of problems just when the student should be undertaking problems, and treatments, of a more professional ilk.

TUTORIAL VS. PROFESSIONAL PROBLEMS

What, then, are the differences between the textbook problems addressed by students and the problems addressed by professionals? According to Thomas S. Kuhn,

> "...textbooks do not describe the sorts of problems that the professional may be asked to solve and the variety of techniques available for their solution. Rather, these books exhibit concrete problem solutions that the profession has come to accept as paradigms, and they then ask the student, either with a pencil and paper or in the laboratory, to solve for himself problems very closely related in both method and substance to those which the textbook or the accompanying lecture has led him."[5]

Though Kuhn is speaking of science textbooks, his distinction between tutorial and professional problems is equally applicable in engineering. The distinction is confirmed, for example, by engineering educator Jay W. Forrester of MIT. According to Forrester:

> "[The engineer] must identify the significant and critical problems, but in his education, problems have been predetermined and assigned. He must develop the judgment to know what solutions to problems are possible, but in school the problems encountered are known to have answers. He should be excited by new and unsolved challenges, but for 20 years he has lived in an educational system where he knows he is repeating the work of last year's students."[6]

In short, both Kuhn and Forrester perceive a radical difference between tutorial and professional problems. A fuller contrast of the two types of problems is presented in the following table:

Table 1. Comparative Features of Tutorial and Professional Problems

	Tutorial Problems	Professional Problems
Origin	discipline-generated (autotelic)	organization-generated
Nature	pre-formulated, fully specified	ill-defined, ambiguous
	closed	open-ended
	general, abstract, formal	specific, concrete, practical
	"ideal"	"real"
Scope	context-impoverished, fragmented, atomistic	context-rich, holistic
Solutions	homogeneous, mathematically tractable,	heterogeneous
	pre-determined, unequivocal	provisional, multiple

Thus, on the one hand, the problem addressed by the student has been preformulated and fully specified; the single specific answer required is obtained using an analytical method which has just been introduced in the classroom. On the other hand, the problem addressed by the engineer is often ill-defined and is delineated along with various prospective solutions, only through diverse engineering activities. The engineer then chooses among these provisional solutions on the basis of comparative evaluation of projected cost and effectiveness; in effect, tradeoffs are made to realize the most cost-effective solution.

DISSOCIATION OF ACADEMIC AND PROFESSIONAL SPHERES

The enormous disparity between tutorial and professional problems is symptomatic of the long-standing dissociation of the academic and professional spheres of engineering. Surveying the history of engineering in the United States, Lawrence P. Grayson notes:

> "Almost from its beginning engineering education in the United States was in all essential aspects a form of collegiate education, instituted and directed by educators, rather than practitioners. It was firmly established before the profession organized itself, with curricula in the various branches of engineering being taught and degrees offered, before the corresponding professional societies were formed. As a result, engineering education did not evolve from apprenticeship training and only slowly replaced it, gaining the support of practitioners with considerable struggle... . These beginnings were directly opposite to the manner in which education for the legal, medical and dental professions developed in the United States, as they evolved out of apprenticeship on a purely practical and technical plane, with none of the general qualities of collegiate education."[7]

Grayson is speaking of the origins of engineering education for the older specializations, such as civil engineering, which though not professionally based was nonetheless technically rather than scientifically based. Engineering education for some younger specializations, such as electrical or chemical engineering, was originally scientifically rather than technically based, however, and the dissociation of "the professional" and "the academic" was even more pronounced. Admittedly, educations in the electrical and chemical specializations evolved from their scientific origins toward a technical base. However, this evolution was halted in the post-World War II and post-Sputnik eras which saw, in fact, an increasing commitment to the pure sciences in engineering curricula. The incursion of pure science into the curriculum occurred at the expense of the technical component; the professional component remained virtually absent.

In the modern era, science courses predominate in the first two years of engineering curricula; a strong scientific coloration persists into the last two years of undergraduate study. Moreover, these scientifically oriented curricula have increasingly been taught by a faculty with a science-oriented

education and little if any professional engineering experience. As the Goals Report of the ASEE notes: "Young men are entering faculty careers with doctoral degrees but with little if any experience in the practice of engineering."[8] The significance for students of having instructors with little or no professional engineering experience is summarized by Eric A. Walker: "There are engineers who graduate with little or no exposure to engineering because they have not studied with teachers who are engineers."[9]

What are the implications, for the professional communication instructor, of having engineering students trained in a discipline dissociated from a professional base at its very origins, enrolled in a science-oriented curriculum, and taught by instructors lacking professional experience? One implication seems clear: Rhetoric instructors should not consider engineering students experts in the articulation and treatment of problems addressed typically by professionals. In the remainder of this paper, we attempt to further substantiate this assertion largely on the basis of experience with a course in technical and professional communication. We discuss typical student difficulties in the selection and treatment of technical problems in simulated professional reports. Based on results obtained with questionnaires and in-depth interviews, these difficulties are traced to the use of tutorial materials as sources. Representative case histories are used to illustrate typical pitfalls in adapting tutorial source materials. We close with a few suggestions on the handling of the technical problem by rhetoric instructors.

THE COURSE; THE DIFFICULTY

We are involved in a senior-level, multi-sectioned course in technical and professional communication in the College of Engineering of the University of Michigan. The course objective is to train engineering students with a wide variety of specializations to write professional reports which are instrumentally useful for diverse audiences in organizations. Course assignments entail the generation of technical communications in which problem formulations are presented, and solutions advocated, for such audiences. The course is officially restricted to students who have had professional experience or who have taken, or are concurrently enrolled in, project or design courses; theoretically, such students should have no difficulty in fulfilling the assignments. In fact, however, most of our students have great difficulty in properly selecting, articulating and treating appropriate problems.[10] Why? In search of answers to this question, questionnaires and follow-up in-depth interviews were used over a two-year period among approximately 200 students. Two conclusions emerged: First, many students in the course do not meet the stated background requirements. Second, most students have major difficulties in adapting their selected source materials to meet the requirements of professional engineering reports. Specifically, their difficulties occur mainly because they attempt to adapt materials of an academic, or tutorial, nature. Lacking ready access to professional report materials, most students turn--somewhat understandably--to materials at hand, that is, to tutorial materials in their academic environment. Yet, as we have shown earlier, these materials usually differ profoundly from professional materials in both the nature and treatment of problems. Not surprisingly, then, the adaptation usually poses great difficulties.

CASE HISTORIES

Typical student difficulties are portrayed in the following case histories.

Case History 1. Lacking professional experience, Laura K. understandably turned to the most readily available materials--in this case, to a term paper written for a course dealing with integrated-circuit technology. She therefore wrote a report, ostensibly at her supervisor's request, summarizing the procedural steps for manufacturing integrated circuits in several different technologies. Like the term paper itself, the report showed the characteristic preoccupation of students with subject matter, and was largely pre-engineering in nature. Though the materials earned an "A" grade as a term paper, the report based on these materials was less successful. The response of an actual organization would surely have been: "How does this affect us?" or "Why should we know about this?" In fact, authorization of an organization report on so gratuitous a problem is unlikely. Rather, a report might have been requested in response to a question such as: Can changes in fabrication procedure increase productivity of our manufacturing division and produce profitability? This question in fact provided the basis for a later, and more successful, version of the report. However, lack of sufficient quantitative data became a serious difficulty when she attempted to address a specific organizational problem. Thus, though some deficiencies were remedied in the initial adaptation of the term paper, new ones arose when the treatment of a meaningful problem was undertaken: Clearly, she lacked such critical information as costs and yields under both the "old" procedure and the "new" procedure advocated in the report. Her solution, not infrequent in these cases, was to invent missing data in the interests of rhetorical effectiveness of the report--an exercise of highly dubious educational worth. Similar report scenarios are common among students who, lacking any sort of professional experience, turn for working materials to lecture notes, textbooks, or their counterparts in professional journals, i.e., the tutorial article. The difficulties of Laura K. are representative: They were, in fact, shared by Peter B. who wrote a report describing the architecture of a large-scale computer system based on lecture materials provided in a computer course; they were shared, equally, by David M. whose report discussed the general merits of high-voltage DC transmission based on a tutorial article in Spectrum, a journal of electrical engineering.

Case History 2. Unlike Laura K., Jeff R. began with meaningful organizational and technical problems: The construction company for which he "works" had seen a possible need, on the grounds of increased safety and marketability, for installing household fire-warning systems in homes under construction. Jeff's task was to assess the need and, if deemed appropriate, to specify the hardware to be installed. This is a very plausible engineering problem; however, the execution of the task, as described in his report, was largely ineffective. His basic difficulty was improper selectivity: He failed to raise critical issues, raised others which should not have been debated, and treated still others in insufficient detail. As a result, many of his decisions seemed, or were, arbitrary--and the report was unconvincing. For example, failure to recognize, generally, the relevance of building and

occupancy codes was a serious technical omission which ultimately impaired the rhetorical effectiveness of his report. In fact, the code requirements provided the one incontestable argument for installing household fire-warning systems. An organization might approve the recommendation that household fire-warning systems be installed on the grounds of humanitarian concern and possible enhanced marketability of the homes; it would certainly approve an installation which was a precondition for their sale. The failure to acknowledge requirements of operant codes led Jeff to consideration of issues which need not have been raised: For example, his fairly lengthy discussion of the merits of smoke-, as opposed to heat-, detectors was relatively persuasive, though somewhat beside the point, since the codes dictated the inclusion of smoke detectors. A more general characteristic of the report materials was a lack of sufficient detail. In consequence, his report recommended installing a system which seemed arbitrary in many respects: in the choices of ionization-, rather than photo-electric-, type smoke-detector units; of battery-powered, rather than line-powered, units; of five units to protect a three-bedroom home; of the placement of the units; and, indeed, of the specified model rather than, say, one of the competitive units available. Unfortunately, a lack of sufficient detail is easier to diagnose than to correct. In Jeff's case an extended effort would have been needed to access the information required to deal effectively with the issues involved. For example, a choice of a smoke-detector model for installation would certainly have entailed a comparative study of the specifications of a cross-section of commercially available units. The accummulation of a list of manufacturers, preparation of letters of inquiry, and wait for responses would have taken several weeks. When coupled with other demands of the problem, the total time and effort required for information accessing by a student becomes disproportionate in a course on technical communiation. But Jeff's pitfall, arbitrariness, is shared by many students: For example, improper treatment of cost factors is endemic in student reports.

The above case histories portray representative problems encountered by students who, though lacking professional experience, are nevertheless asked to stimulate an effective professional treatment of a meaningful technical problem. As we have seen, many of these problems can be traced to the nature of the typical sources used--textbooks, lecture notes, laboratory reports, tutorial articles.

SUGGESTIONS

Based on the foregoing analysis of student difficulties in articulating and treating technical problems, a number of suggestions can be made to help teachers of technical communications address more effectively the issues of professionalism. These suggestions range from general speculations on the nature and placement of professional communication courses in curricula to specific heuristics for evaluating the treatment of the technical problem by the student. What follows, then, is a series of suggestions with comments.

Suggestion 1: Consider introducing students to professional problems and the treatments demanded, in a communication course offered early in their academic programs.

Comment: We have found the case a promising method of confronting inexperienced students with a set of carefully metered demands to articulate, solve and report a "real-life" engineering problem within an organizational context.[11] A

case problem should be chosen which is "real", of general interest among engineering students, and of circumscribed difficulty.[12] The case materials provided students should probably be chosen with the cooperation of a member of the technical faculty.

Suggestion 2: Consider deferring a course in professional communication until late in the program, that is, until the senior year.
Comment: Such deferral, widely advocated in the literature,[13] has several advantages: First, more students will have had some sort of "professional" experience; certainly greater numbers of students will have taken either project or design courses--courses traditionally conceived as bridging the gap between "the academic" and "the professional." Second, regardless of the degree of exposure to professionalism, seniors will at least have more expertise with the technical subject matter of their engineering specializations. Third, seniors who are about to join the professional work force will understandably be more motivated to acquire the communication skills needed by professionals.

Suggestion 3: Whether you decide to introduce your students to professional communication early or late in their program, design your course to bridge the gap between "the academic" and "the professional" as that gap exists at your institution.
Comment: To do this, you need to consider both where your students are going to and where they are coming from. The nature and treatment of academic and professional problems have been characterized here in general terms. Beyond this, we endorse the oft-made suggestion that you learn more about the standards and conventions which your students will have to meet as professionals.[14] Equally as important, though relatively unnoted, is the need to understand in some detail the degree to which your students have been introduced to principles of professionalism in their course work. Clearly, answers to questions such as the following are helpful: For which engineering specializations, if any, is there a project- or design- course requirement at your school? In what numbers have your students availed themselves of opportunities for outside organizational experience through, for example, co-operative or summer programs? What pedagogical concessions need, and can, be made in the light of the backgrounds of students in an individual class?[15] In summary, profiles are needed for your engineering students in general, by specialization, and by individual class.

REPORT EVALUATION

Suggestion 4: In reading reports, assume responsibility for assessing the degree of professionalism manifested in the articulation and treatment of technical problems by students. As a corollary, don't let students relinquish responsibility for simulating treatment of appropriate problems at a professional level.
Comment: Do not assume the student is an expert in the articulation and treatment of problems addressed by professionals. Students may have mastery of technical subject matter, but not of professional problem treatment. Lacking such mastery, students attempt at times to persist in treating problems in imputing the academic, tutorial mode, e.g., by inputing to a supervisor the assignment of a task of sub-professional, or pre-professional, nature. Consider as suspect, then, any task assignments of the general form: "My boss asked me to [perform a sub-professional, or pre-professional, task]."

Suggestion 5: In examining reports, focus primarily at the level of underlying deep structure, or of disciplinary paradigms, rather than at the level of surface textualization.
Comment: To do this, you should be aware of the conventions underlying various discourse types in academic and professional writing. Armed only with a knowledge of the appropriate structural paradigm, the rhetoric teacher--however unfamiliar with the surface textualization of a given report, be it op amps or strain gages--can readily detect many serious flaws. Consider, for example, the structural paradigm for a problem-solving organizational report, which has the following elements: statements of the problem, methodology, results, conclusions, recommendations, and implications for the organization (i.e., cost, benefits, future actions required). A teacher familiar with this paradigm is able to question the omission of an element, such as recommendations, from a problem-solving organizational report. But both teacher and student can gain additional insight by comparing the paradigmatic elements of such an organizational report with their counterparts in the appropriate academic discourse genre--especially since, as we have shown, students tend to turn to such sources. Such a comparison is made in Table 2, using the student laboratory report as the academic discourse genre.

Table 2. Comparison of the structural paradigms for a student laboratory report and a professional problem-solving organizational report.

	Student Lab. Report	Professional Report
Technical Problem	tutorial	professional
Methodology	highlighted	de-emphasized, if standard
Results	emphasized	details appended
Conclusions	emphasized, but narrow	emphasized
Recommendations	omitted	emphasized
Implications	omitted	emphasized

In the case under discussion, recommendations may well have been omitted because they are not ordinarily called for in a student laboratory report. Figure 2 illustrates, then, one example of the level at which you should be not only reading reports but also characterizing discourse types for your students. It is implicit in the above discussion that we do not advocate an attempt to master the subject matter of, say, an electronic circuit text or a dynamometer user manual.[16] However, we do advocate familiarization with the structural paradigms underlying discourse sub-genres such as textbooks and user manuals.

Suggestion 6: Be aware that the norms underlying various engineering paradigms evolve, and try to keep up with changing conventions.
Comment: An example might be helpful here. The traditional professional design paradigm includes the following elements: function, cost, manufacturability, and marketability. Note, however, that traditional design education is focused largely on function. Following the method of Suggestion 5--detection of possible student errors through a comparison of academic and professional paradigms--we are led to expect, and indeed find, imbalances in student treatments of the four elements of the professional design paradigm. But more relevant to our present point, this paradigm is evolving. Specifically, the addition of

safety to the traditional design paradigm is increasingly regarded as mandatory.[17] Moreover, because this design criterion is just beginning to be recognized in engineering education, one expects its omission to be the exception rather than the rule in student writing. Trends such as energy and resource conservation, and environment protection, are inducing further evolution of the professional design paradigm.

Suggestion 7: Don't accept arbitrariness--a characteristic of treatment of formal, tutorial problems--at any level of a professional report.
Comment: In an earlier discussion we noted that while tutorial problems are abstract, idealized and general, professional problems are concrete, "real", and specific. Thus, while a circuit may "operate at 300°K" in a textbook discussion, qualification is required in a professional description. The qualifications required in professional treatments of a problem often take the form of ranges. In the example cited above, specification of an operating temperature range would be required, e.g., 300± 2°K. Similarly, the provisional, multiple nature of solutions to professional problems should lead you to challenge any solution deemed, in effect, unique. Remember that you need not have the specific answers to ask the right questions.

CONCLUSION

In the above suggestions, and in the paper as a whole, we have tended to treat engineering in the broad sense as normatively conceived. But, as we noted in the case of evolving design criteria, norms change and the conventions for the engineering profession are neither monolithic nor static. Nor are they ever fully realized in any given instance: The claim has been made, for example, that many of today's engineers are working at sub-professional levels.[18] How does the rhetoric instructor accommodate the statistically significant group of students who may have this destiny? Or to treat the other side of the coin, in effect, a certain number of educators--including ourselves--are calling for a new engineering professionalism.[19] Jay Forrester calls, for example, for a renaissance figure who "should act as the interface between technology, economics, organization, and politics."[20] What, if any, should be the rhetoric instructor's role in producing this new engineer? Whatever choice is made, pedagogical decisions have moral implications. And those decisions should be conscious and responsible.

FOOTNOTES

1. See, for example, Fred H. MacIntosh, "Teaching Writing is the World's Work," The Teaching of Technical Writing, eds. Donald H. Cunningham and Herman A. Estrin (Urbana: NCTE, 1975), p. 29: "But make clear to your students that content is their responsibility, and that your concern is clarity of presentation..." The historical emphasis on style and arrangement is confirmed and related to the tradition of scientific positivism by Carolyn R. Miller in "A Humanistic Rationale for Technical Writing" College English, vol. 40, no. 6, Feb. 1979, pp. 610-17.

2. For a notable exception, see the pioneering treatment of the technical problem in J.C. Mathes and D.W. Stevenson, Designing Technical Reports: Writing for Audiences in Organizations (Indianapolis: Bobbs-Merrill, 1976), especially Chapter 3.

3. Moreover, we are told that students "enjoy the opportunity to teach their teachers." Paul V. Anderson, "Teaching the Teacher What Government and Industry Want from Technical Writing," Technical and Professional Communication: Teaching in the Two-Year College, Four-Year College, Professional School, ed. T.M. Sawyer (Ann Arbor: Professional Communication Press, Inc., 1977), p. 66.

4. Marion K. Smith, "What Should be Taught in the Technical Writing Course?" in Technical and Professional Communication, pp. 46-47.

5. Thomas S. Kuhn, "The Essential Tension: Tradition and Innovation in Scientific Research," The Essential Tension: Selected Studies in Scientific Tradition and Change (Chicago: University of Chicago Press, 1977), p. 229.

6. From a speech entitled "Engineering Education and Engineering Practice in the Year 2000" and delivered during the National Academy of Engineering session of the Engineering Sesquicentenial Celebration at the University of Michigan on September 21, 1967.

7. "A Brief History of Engineering Education in the United States," Engineering Education, Dec. 1977, p. 246.

8. Cited in Eric A. Walker, "Teaching Research Isn't Teaching Engineering," Engineering Education, Jan. 1978, p. 306.

9. Ibid.

10. For the occasional student with professional experience and professional report materials available, fulfilling course assignments poses no great difficulty. This individual need only select from personal files a report which can be adapted, if necessary, for purposes of the course.

11. For a discussion of our experiences with the case method, see Ben F. Barton and Marthalee S. Barton, "Bridging the Gap Between Engineering Student

and Professional: The Case Method in a Technical Communication Course," Courses, Components, and Exercises in Technical Communication, ed. Dwight W. Stevenson (Urbana: NCTE, 1981).

12. These three criteria underlay our choice of a case problem. That is, we sought first a "real" problem representative of those actually encountered in practice by entry-level engineers. Second, we wanted a problem which could be handled without a deep understanding of concepts peculiar to any one engineering specialization, a problem which would permit a focus on the structural paradigm underlying all engineering specializations, i.e., the problem-solving methodology. Third, we desired a problem which could be treated adequately in a one-term technical-communication course.

13. See, for example, J.C. Mathes, Dwight W. Stevenson, and Peter Klaver, "Technical Writing: The Engineering Educator's Responsibility," Engineering Education, Jan. 1979, pp. 331-34; W.E. Britton, "The Trouble with Technical Writing is Freshman English," Journal of Technical Writing and Communication, Spring 1974, pp. 127-31; T.M. Sawyer, "First Things Last: Composition for Seniors, not Freshmen," Journal of Technical Writing and Communication, April 1971, pp. 139-46.

14. Paul Anderson ("Teaching the Teacher," p. 65) goes so far as to suggest that "[t]eachers of technical writing are not fully trained until they have worked as writing specialists in business, government, industry or wherever they expect their students to be employed after graduation."

15. For example, it was recently possible in a section which happened to have 10 students from a single chemical-engineering design course, to encourage team report-writing--an important aspect of professional activity.

16. Our position differs, then, from that implied by advice such as the following: "Your first logical question may be: how can I teach students to write about things of which I know very little? The first obvious answer is: Read the texts, materials, manuals, and instruction sheets your students use in their career courses. Most of these materials are simple and lend themselves to fast reading for general information. Make clear to your students that context is their responsibility and that your concern is clarity of presentation..." Fred H. MacIntosh, "Teaching Writing is the World's Work," p. 29.

17. See, for example, Tim A. Jur et al., "Engineering, the Law, and Design Education," Engineering Education, Jan. 1981, p. 274: "The elimination of unreasonable [sic] risks of inquiry has become a significant design constraint and must not be overlooked in the design education process." Also, J.M. Christensen, "Implications of Product Liability for Engineering Design and Education," Engineering Education, Dec.1977, pp. 274-77.

18. William S. Byers, "Should Engineering Graduates Be Allowed to Become Technologists?", Engineering Education, May 1977, p. 761: "It is probable, by ECPD's definitions, that a majority of engineers in industry

are performing as technologists." See also Clarence W. de Silva, "The Computer: Obstacle to a Meaningful Engineering Education," Engineering Education, Jan. 1981, p. 304: "On the other hand, there are industries that often use qualified engineers as computer users rather than as productive engineering problem solvers."

19. Ben F. Barton and Marthalee S. Barton, "Toward Teaching a New Engineering Professionalism: A Joint Instructional Effort in Technical Design and Communication," in Technical and Professional Communication, pp. 119-28.

20. "Engineering Education and Engineering Practice in the Year 2000."

Technical Writing in America: A Historical Perspective

Michael E. Connaughton
Assistant Professor of English
Pittsburg State University
Pittsburg, Kansas 66762

> Style is the dress of thought; a modest dress,
> Neat, but not gaudy, will true critics please.
> --Samuel Wesley, "An Epistle to a Friend
> Concerning Poetry" (1700)

> The correspondence between every person's thoughts and language is perhaps more strict, and universal, than is generally imagined . . . [and] the ideas of words will accompany the ideas of things.
> --Joseph Priestley, The Rudiments of English Grammar (1761)

The distinction made here between Wesley's expressive and Priestley's referential language is in part responsible for the gulf between science and the humanities, and it may also account for the distress many teachers of English feel when faced for the first time with the prospect of teaching technical writing. To the humanistically educated critic-scholar, the utilitarian prose of science and technology seems to defy description and analysis, so that technical writing is often approached in terms of what it is not, with emphasis on the features of "normal" rhetoric it eschews. The technical writer's goal, Priestley elsewhere reminds us, is to "let every word stand in such a place and connection, as that its meaning shall be in no danger of being mistaken,"[1] a caveat echoed in the introduction of many of our technical writing textbooks, but which seems to divorce technical communication from other forms of linguistic experience by making language limiting and reductive rather than creative and expansive. Achieving clarity, Hugh Blair reminds us in the 1780's, is a more complex process than simply eliminating verbiage, nor is it a "sort of negative virtue, or freedom from defect."[2]

I believe that the emphasis on technical/scientific writing as radically different has blindedus to those traits it has in common with all species of composition and has caused us to neglect research on fundamental rhetorical issues. Our teaching, too, should be informed by a thorough knowledge of rhetorical theory, even if this is never communicated directly to students. A complete theory of technical discourse would include information about the attitudes and motives of writers, the situations which motivate (or coerce) them to write, the definitive features of technical style and form, the interrelationship of expression

and scientific modes of creativity, and the functions of communication in shaping and preserving scientific networks and institutions.

These areas should be explored with respect to contemporary practice, and many researchers are precently so doing. I believe, however, that there is much to be gained by viewing them within a historical perspective. Some potential benefits of such a study, beyond those usually ascribed to historical research, include the following:

1. It would show longterm trends in technical writing and enable us to choose intelligently from the available developmental paradigms (continuum, cycle, evolution, etc.), to delineate stages, if any, in the genre's development, and to determine the relationship between scientific progress and the communication of it.

2. The written historical record concerning such subjects as the exigencies which give rise to scientific discourse or the authors' attitudes towards rhetoric may be more revealing than the stated beliefs of modern practitioners working within well-established conventions. The same holds true for the impact of Thomas Kuhn's paradigms or disciplinary matrices on scientific language. Historical material may provide a better sense of the uses of metaphoric language simply because discarded models are more easily recognized and analyzed; it may be that the corpuscular theory of matter proved deficient because of its semantic implications as well as because of experimental evidence. As in our composition classes, the failures of language may prove more analytically valuable than the successes.

3. Finally, and most important, the struggle of early scientists and engineers to create viable forms of communication, to adapt and disseminate the informational content of their developing disciplines to varied audiences, and to build acceptable channels of communication is a potentially enlightening, heretofore unexamined aspect of the history of science and technology.

This study is best carried out by teachers of rhetoric, literature, and technical writing. With well-developed critical faculties, a commitment to historical accuracy, and an orientation towards the values underlying human endeavors rather than towards the recounting--or simply counting--of the results of those endeavors, the humanities scholar is in a unique position to understand the broad implications of the history of technical writing. Specialists in the history and philosophy of science have concentrated almost exclusively on the content of scientific communication and have ignored the history of rhetoric. Brooke Hindle's ground-breaking study of the American Philosophical Society (APS), for example, ignores a large body of evidence concerning the Society's debates over the nature of scientific writing, carried on during the last decades of the eighteenth century as it initiated its Transactions, which as the first substantial scientific periodical constitutes the Society's most enduring contribution to American science.[3] Those few colleagues in our own departments who are at all interested in science deal only with its impact on literature. The few existing historical

studies of technical writing are the unsystematic appraisals of non-scholars, hastily researched and sometimes inaccurate papers and articles scattered in out-of-the-way journals and proceedings, or well intentioned but analytically unprofitable discussions of the "hidden poetry of science."

Since last summer, I have been systematically reappraising the roots of American scientific writing. Initially, I have focused on scientific and medical societies and their publications, both because the paper and report remain the standard forms of scientific discourse and because these organizations, notably the APS, possess extensive archives and libraries of early scientific activity. After only six months of research, I am not yet prepared to provide even in the broadest outline an overview of American scientific writing up to the present. I will, rather, describe its practice in the earliest phase, from the beginning in the seventeenth century until approximately 1815, when specializations begin to coalesce around professional organizations and specialized journals. In doing so, I will seek to answer some of the questions posed earlier about writers, texts, and readers.

In its initial, immature phase, American science saw its essential tasks to be observation and data compilation rather than theory formulation. This situation results from the scarcity of practitioners conversant with scientific theory and the overriding influence of Francis Bacon, whose system insisted upon these as the most fruitful scientific activities, and in part from the colonial mentality in general and a two-tiered international system of "absentee landlordship in science" in which Europeans alone were granted license to interpret data gathered from peripheral sites.[4] Like their counterparts in England, seventeenth-century Americans presented their observations in the unadorned, nominal style of the Royal Society, with figurative language employed only to translate unfamiliar phenomena into familiar terms, a heavily Latinate vocabulary, and a very limited technical lexicon. Samuel Danforth of Cambridge, Massachusetts, who has as good a claim as anyone to the title of first American scientist, is typical in these respects.[5] For example, his Astronomical Description of the Late Comet (1665) is syntactically straightforward, with very short sentences even by modern standards; ponderously learned ("This Comet is no lunary Meteor or sulphureous Exhalation, but a Celestial Luminary."); and simplistically metaphorical ("A Comet is denominated from its Coma or Bushy lock, for the Stream hath some resemblance of a lock of hair."). Since the colonial audience for such works was severely limited--amateur enthusiasts, scattered University faculty, and the clergy--the usual outlets were British publications such as the Philosophical Transactions of the Royal Society, Medical Observations and Inquiries (1757-84), and Medical Essays and Observations (1733-42), which despite their titles accepted communications on a complete range of scientific topics.

Along with the clergy, physicians constituted the largest class of scientifically literate persons in the colonies, though apparently less than one in ten had the benefits of formal education.[6] A medical disaster, the outbreak of the "throat distemper" in New England during the 1730's, provided the impetus for the first extensive medical publication in America. The letters, pamphlets, and newspaper articles published at this time show the range of styles writers adopted and their awareness of different audiences. Descriptions of symptoms by a clergyman and two physicians indicate very different responses to the problem of style:

Rev. Jonathan Dickinson: "I take this Disease to be naturally an Eruptive milliary Fever. And when it appears as such, it usually begins with a Shivering, a Chill, or with Stretching, or Yawning; which is quickly succeeded with a sore Throat, a Tumefaction of the Tonsils, Uvula, and Epiglottis, and sometimes of the Jaws, and even of the whole Throat and Neck. The Fever is often acute, the Pulse quick and high, and the Countenance florid."

Anonymous (probably Dr. John Morgan): "During these appearances, the throat seem'd, as it were, full and swell'd and the patient seldom failed to complain of great soreness, had an evident hoarseness and sometimes a cough. The pulse was generally full and quick, yet attended with some remissions and even sinkings."

Dr. William Douglass: "[T]he reliquiae were thrown off by Urtications, by Vesications in several parts of the Body, by serpiginous eruptions chiefly in the face, by purulent Pustules, by Boils, by swellings and impostumations in the groin, armpits and other parts of the body."[7]

The first two passages address a lay audience and thus communicate in relatively familiar terms. The style of the clergyman and the physician are essentially indistinguishable, though Dickinson uses a slightly more elevated vocabulary. Elsewhere in their articles, both suggest a humane concern for the patient, Dickinson referring at several points to the struggle of "the poor miserable Creature." Their sense of stylistic decorum also permits literary allusions and stylistic ornaments to play minor roles: Dickinson characterizes the disease as a mortal enemy, and Morgan depicts his struggle in dramatic and military images and at one point alludes to Dryden to underscore his opposition to bloodletting.

Douglass's description more closely resembles the jargon-laden prose for which physicians have become notorious, especially when addressing other "Gentlemen of the profession" (p. ii). Even to his colleagues, however, his elaborate phrasing is excessive: Dr. Samuel Bard, a professor of medicine at Columbia, though quoting him approvingly for his "accurate and judicious" observations, finds them needlessly obscured by his "singularity of style."[8] In fact, Douglass's high-sounding vocabulary describes such commonplace phenomena as blisters (vesications), a spreading rash (serpiginous eruptions), and abcesses (impostumations).

In the twentieth century, the motives for producing a given piece of technical writing are conventional, clearcut, and objective: the advancement of knowledge, generation of a specific output or product, or meeting some predetermined goal (e.g., reporting progress or proposing some course of action). Personal motives, such as advancing one's career or reputation, remain implicit. In the early years of scientific activity, motives are more diverse and tend to be stated directly. They include patriotism and the desire to be useful to society, the desire to spread rather than advance knowledge, personal ambition, stimulation of controversy or at least parallel activity, inquiry (often disarmingly naive), and, perhaps most important, the desire to create the bonds within a field of inquiry which will lead to its professionalization.

Most of the latter motives can be inferred from the writings under consideration. The most apparent are the desire to be useful, to promote professional standards, and to stimulate scientific activity in others. All three writers insist that their writing promotes the general welfare by sharing their specialized knowledge with the public. All also point with satisfaction to their professional concern for detailed observation; Morgan is exemplary: "As the State of Physic now stands, the Faculty having been amused with different Theories for many ages have concluded, that reasoning from observation and facts . . . is the only basis on which we can rest with safety" (p. 164). This Baconian emphasis is the single trait most common in all early American science and the most obvious method of distinguishing cognoscenti from amateurs. In subsequent years, a significant proportion of the papers the APS rejects are cited for their failure to observe and describe with scientific thoroughness and accuracy. Douglass is concerned not only with standards of observation (his labored vocabulary no doubt to his mind contributes to this objective), but also with using publication specifically to establish a network of researchers cooperating on a common problem. Douglass is also careful to underline his objectivity by dissociating himself from those who publish their findings solely as a "Quack bill to procure Patients" (p. ii). Half a century later, the hope of eliciting professional cooperation stimulates the editors of the Medical Repository, the first successful American medical journal, who see a "medical collection" of "an extensive mass of experiment [and] a various and judicious selection of facts" as the surest way to progress.[9]

The need of early scientific writers to establish credibility necessitated a personal tone far removed from the conventional objectivity of modern practice. Just as seventeenth-century correspondents to the Royal Society were careful to include such code words as "ingenious and industrious" or "curious and inquisitive" gentlemen in identifying themselves and their informants, American writers in the eighteenth century are careful to account for their sources' reliability and, if at all possible, to observe phenomena with their own eyes. An excellent instance

of this trait occurs in another of Dr. Morgan's papers, an account of "A Living Snake in a Living Horse's Eye" in the APS Transactions. Morgan devotes two pages to discussion of "miraculous appearances," his own opposition to "visionary speculatists," his hypothesis that the creature in question is a "filimentary production" animated by a "convulsion in the nerves," and, finally, his assurance after "the closest ocular examination" that the "snake" (actually a parasitic worm) is genuine.[10]

One result of this need to establish one's personal credibility is a more argumentative tone in much of the writing than modern conventions would permit. Douglass, for example, refers scornfully to the "rash inconsiderate opinion[s]" and "mischievous Practice[s]" of other physicians treating the throat disorder (pp. 2-3). In this combative atmosphere, it was normal for such arguments to be quite protracted. Manuscripts in the APS archives indicate that the inventor Oliver Evans continued to inveigh in print against Benjamin Latrobe for criticizing his steam engine eleven years after the fact, even though that criticism was a single paragraph (which Evans never saw) in a draft report which Latrobe excised prior to its publication.[11]

The most successful effort to impose order and standards upon scientific writing was the publication of the APS Transactions, a collection modeled closely upon the Philosophical Transactions of its parent organization, the Royal Society. The publication's history is too complex and its quality is too uneven to recount in detail here; during its initial stage of development, six volumes appeared at irregular intervals from 1769 to 1809. Its primary accomplishments are several: it imposed minimal standards for form, methodology, and style, though the latter were applied unevenly; it instituted an increasingly successful referee system to consider papers; although it usually published papers as received, it also printed the first edited and collaborative papers to appear in this country;and, most important, by distributing scientific writing far more widely than previously possible, it encouraged imitators and provided a model for potential contributors.

The standards for publication were not initially high; the Society's highly regarded observations of the 3 June 1769 transit of Venus across the face of the Sun comprised nearly half of Volume I, and other papers on hand in agriculture, medicine, mathematics, and natural history, including some previously published material, were included to add bulk and variety. A consistent standard, observed in all APS publications, is objectivity. The Society clearly specifies that its members will not "give their Opinion, as a Body, upon any subject, either of Nature or Art, that comes before them."[12] Occasionally this rule resulted in minimal editing, as in a paper by John De Normandie concerning "The Therapeutic Value of the Waters of Bristol, Pennsylvania," a republication

of two earlier articles in the Pennsylvania Journal and Pennsylvania Gazette (both 6 October 1768).[13] Two paragraphs are removed, perhaps because they have too much the tone of an advertisement, with references to the Bristol springs' "more remarkable tonick powers than common springs" and "a suitable and convenient house and bathing place" under construction. Except in extreme cases, the Society's official neutrality had little impact on the form or substance of its publications; certainly, it caused the removal of very few hypotheses because they were unacceptable. Only once during this period did the Society approach breaching its operating principle by showing favoritism to one of its own members. This occurred in 1806, when an editorial committee rejected a paper on the origin of icebergs by Samuel L. Mitchell and accepted a similar one within a few weeks by Anthony Fothergill, who was not only a member of the society but also of the committee. Moreover, Fothergill's paper is in many ways inferior: it contains undesirable rhetorical flourishes, is based upon less precise observations, and contains an inferior, contrdictory hypothesis, that icebergs are "gradually formed stratum super stratum . . . attache[d] . . . to the bottom" of the ocean, even though they are "specifically lighter than water." The committee raises the issue of the propriety of its action in its report, and the society as a whole eventually found an excuse not to publish Fothergill's paper.[14] However, nowhere else in the records of this period is there evidence which so obviously calls into question the Society's neutrality.

For the most part, the Society's principle of selection is, as stated in the first volume, "the importance or singularity of the subjects, or the advantageous manner of treating them" (I, iii). The latter phrase refers to the scientific rather than stylistic manner, the use of close observation, experiments, or statistical methods rather than careful writing. Nevertheless, the record indicates that style and form were considerations in some cases. The best example is provided by the record of Benjamin Shultz, an amateur naturalist whose work is best left cloaked in anonymity. Over a ten-year period (1797-1807), Shultz persistently submitted rather lengthy papers on noxious plants, essential oils, animal temperaments, and light. All were rejected, though Shultz sought the patronage of Thomas Jefferson and (more successfully, Dr. Benjamin Rush. Editorial comments on his papers are almost entirely negative ("extremely inaccurately written," "diffuse and irregular"), and the works themselves are models of prolixity, opacity, and confusion. His first paper, on noxious plants, is typical: the first section, eight of its thirty pages, is a rambling parody of a review of the literature, which alludes vaguely to many theories but cites no sources; the discussion itself (sixteen pages) is poorly organized (one-quarter is excursive footnotes and nearly one-half is simply lists of Linnean nomenclature) and riddled with semi-literate metaphorical descriptions("innocent plants," "naked . . . destitute of winged, downy, or hairy Substances," "Calyx . . . cherishing the Seeds in its bosom"); and a "Review" takes up the final six pages, again with nearly one-third of its text extraneous comments in footnotes.[15] Shultz's papers are

valuable only in that they indicate some minimal sense of an appropriate style for scientific writing existed at the end of the eighteenth century, although it is never clearly articulated.

The usual form of submission was the personal letter or memoir enclosed in a letter, although more formal presentations with textual subdivisions and elaborate figures appeared even early on, including at least one "formal report" (Samuel Felsted's "Plan and Description of a Horizontal Wheel," 6 July 1798), a fair manuscript copy, bound in boards, with three well-drafted, pull-out figures. All of the papers submitted at this time are the work of individuals, but a number of articles are collaborations and amalgamations. The most complex example of such an article is William Mugford's "An Account and Description of a Temporary Rudder," which derives from at least four sources: Mugford's original letter and description of the rudder; a newspaper account of its invention; a draft report combining the preceding items and commenting upon them; and an explanation of an illustration, apparently requested from Anthony Fothergill. The published article differs from all four sources in both substantive and stylistic details (including reinstatement of cancelled material from the draft), indicating that yet another writer or editor had a hand in it.[16] The Society did not generally have the editorial resources to rework submissions so elaborately; however, upon occasion a specialist was asked to rewrite or expand promising observations. The naturalist Benjamin S. Barton performed such duties on an anonymous "Observations on the Phalaeena Tinea" (a parasitic moth which inhabits beehives). He expanded a six-page document to forty-four, in the process transforming a chronological memoir into a topically arranged report which incorporated Linnean descriptions, a review of the literature, and his own and other observations from various sources.[17]

One of the APS's most important innovations was its introduction of specialists' committees to determine which papers were suitable for publication. The Society's minutes do not record when such review committees were first established or exactly why. Certainly, no explicit order was given. From its creation, however, the APS used ad hoc committees for such purposes as granting prizes, examining inventions, translating foreign correspondence, and seeing the first Transactions through the press. After the second volume appeared in 1786, references to such committees begin to appear in the minutes, the first on 21 December 1787; however, they are appointed, do their work, and report sporadically and haphazardly. Thirty-five such reports are extant from the period 1787-99, eighty-six from 1800-09, and twenty-three from 1810-15. These reports cover fewer than half of the papers received, and many were lost or delayed. On 27 December 1798, for example, the secretary reported on sixty-two papers received during 1797-98; two-thirds (thirty-nine) were listed as "referred,"

but only twenty committees actually filed reports. The archives also show embarrassing delays: Shultz's paper on noxious plants was in committee for over a year; Barton's paper on "Poisonous Honey" was read on 18 July 1794, never reported upon, and finally published only in Volume V (1802). The worst fate is Robert Patterson's, whose "An Improvement in the Common Ship-Pump" was read on 17 July 1795 but "afterwards mislaid"; it emerges in print twenty-three years later in Volume I of the new series (1818). Such delays were destructive of the journal's prestige and credibility, and competing periodicals were able to publish backlogged papers (four such instances were noted in the minutes in November 1812). The society's most prestigious member, Joseph Priestley, complains in 1798 that he has been forced to send "Articles . . . of considerable importance" elsewhere because the Transactions does "not answer the primary purpose of such publication, which is speedy communication of philosophical discoveries.[18]

By the opening years of the nineteenth century, the sporadic, compendious, uneven Transactions had served its purpose. It had launched American scientific publication, provided some minimal standards for both form and content, and had demonstrated a potentially workable system of manuscript selection. Most important, it had shown that American scientists could work cooperatively and objectively to disseminate the results of their research. The next stage of development, the publication of specialized journals like the American Mineralogical Journal (1810), could not have occurred, nor could such journals have taken on so modern an appearance, without the pioneering work of the APS. Thus, the first generation of scientists in the new republic made substantial progress and paved the way for the professionalization and specialization of scientific communication. Their work, with all its shortcomings and peculiarities, is recognizably the ancestor of modern technical writing; continued study of the historical record will show not only how modern conventions of writing emerged, but also how they were shaped by the socio-cultural forces, creative energies, and personal values common to all scientific, indeed, all human, endeavors.

NOTES

[1] "Observations on Style," The Rudiments of English Grammar (1761; facs. Menston, Yorkshire: Scholar, 1969), p. 50.

[2] Lectures on Rhetoric and Belle Lettres (Philadelphia: Aitkin, 1784), p. 81.

[3] The Pursuit of Science in Revolutionary America, 1735-89 (Chapel Hill: Univ. of North Carolina Press, 1956).

[4] Donald Fleming, "American Science and the World Scientific Community," Journal of World History, 8 (1965), 667.

[5] An observation best relegated to a footnote: the first sentence of the first American publication one could conceivably call scientific, Danforth's An Almanack for the Year of Our Lord 1647 (Cambridge, MA: Matt. Day, 1647), begins with a literary metaphor: "The great luminary, the world's bright eye shall be twice eclipsed this yeare."

[6] Roger Shyrock, Medicine and Society in America, 1660-1860 (NY: NYU Press, 1960), p. 9, estimates that in 1770 only about 200 of 3500 colonial doctors actually had degrees.

[7] Observations on that Terrible Disease Vulgarly Called the Throat Distemper (Boston: Kneeland and Green, 1740), p.2; "Observations on the Angina Maligna, or Putrid and Ulcerous Sore Throat," American Magazine, 1 (June, 1769), 165; The Practical History of a new Epidemical Miliary Fever with an Angina Ulcusculosa (Boston: Fleet, 1736).

[8] Samuel Bard, "An Inquiry into the Nature, Cause, and Cure of the Angina Suffocativa, or Sore Throat Distemper," APS Transactions, OS 1 (1769), 333.

[9] "Cicular Address," 1 (1797), vii.

[10] OS 2 (1786), 385-86.

[11] Benjamin Latrobe, "Report [on] Improvements in the Construction of Steam Engines," 27 May 1803; to John Vaughan, 19 June 1814, both in APS Archives. Unless otherwise noted, all remaining citations are from the APS Archives.

[12] "Advertisement," APS Transactions, OS 1 (1769), iv. The Royal Society had a similar regulation from its inception.

[13] APS Transactions, OS 1 (1769), 70-76.

[14] "Report of the Committee [on] . . . Dr. Mitchell's Paper, " 4 April 1806; "Report of the Committee on Fothergill's Paper on Icebergs," 2 May 1806; "Report of the Committee [on] . . . Dr. Fothergill's Memoir," 3 October 1806; Fothergill, "On the Origin and Formation of Ice Islands and Their Dangerous Effects in Navigation," Memoirs of the American Academy of Arts and Sciences, 3, pt. 1 (1809), 69-81; Mitchell, "An Exhibition of Facts, Showing the Progress of Ice-Islands," Medical Repository, 2nd ser. 4 (1807), 225-35.

[15] Shultz to Thomas Jefferson, 7 November 1797. Committee reports on Shultz's papers, listed chronologically in the Archives, occur on

7 December 1798, 7 February 1800, 2 April 1802, and 17 July 1807. His essay "On Essential Oils" is at the APS in the papers of Benjamin S. Barton under "Miscellaneous Papers."

[16] Mugford to Thomas Hewson, 22 September 1804; "New Rudder," Salem Register, n.p., n.d. (filed with Fothergill, "Remarks"); "Committee Report [on] Mugford," 13 February 1805; Fothergill, "Remarks on Mugford's Rudder," 15 February 1805. The article appeared in APS Transactions, OS 6 (1809), 203-08.

[17] W.J., "Observations," 1 November 1812; Barton, "Additional Observations on Bee-Hive Moths," 16 December 1812.

[18] Priestley to Benjamin S. Barton, 8 August 1798. Pennsylvania Historical Society.

TECHNICAL COMMUNICATION: NOTES TOWARD DEFINING A DISCIPLINE

Philip M. Rubens, Associate Professor
Department of Language, Literature and Communication
Rensselaer Polytechnic Institute
Troy, New York 12181

Perhaps this is simply an era when simplistic solutions to complex problems becomes a dominant theme for our age. It has somehow become fashionable to make very general statements and present them as universal truths. In the field of technical communication, for instance, one can survey the definitions posited in virtually any major text and discover that each one violates every major rule of definitions. The most popular method for defining the field is to state that technical writing is any writing that supports technology or technological activities. One then is left with a hollow feeling that he/she needs a nice yardstick for measuring what "technology" is. One is also left with a nagging, perhaps niggling, doubt that there is something subversive, perhaps even anti-humanistic about "supporting technology." It seems to me that we have to stretch this definition in some ways and collapse it in others; I don't, however, want to put this effort on a Procrustean rack. I want to suggest, first, some ways in which the field can be defined in a tightly structured empirical way and, second, to posit the implications of technical communication for a humanistic education in a technological age.

Unlike any other field, with the possible exception of science writing, technical writing, strongly implies that there is a clear emphasis on the product. In this sense it is at one with the field it claims to support. We find that even in the works of such people as Herbert Simon, the key feature of technological activities is the production of artifacts. It is this informing principle of technology that, I believe, tends to obscure the definition of technical writing in all of its possible permutations. Editors in the corporate environment express their concern only about the lack of documentation for a new product; that concern is not tempered with a concomitant regard for the veracity or usefulness of the document (nor for that matter, is there any interest in the ethical dimensions of the document).

This drive for product has another deleterious effect on technical writing: it creates a focus on words as a variety of transparent symbols that work best when they don't get in the way of the user. James Kinneavy, for instance, proposes this view of referential language in support of technological activities. What is clearly (no pun intended) wrong with this perspective is that words become less than words. Their task is to slip through the reading process with the least amount of effort and to elicit as little attention as possible. Unfortunately, we know from such theorists as Michael Polanyi, Gerald Holton, Thomas Kuhn, and Larry Laudan that language and technological thought (activity) simply don't work that way. There is no such animal in the entire world as an unambiguous text (or illustration for that matter). All reading, as Iser, Rosenblatt, Bleich,

and others have argued, is an interactive process informed by the readers interests and background. This counter argument is interesting for a variety of reasons. First, it refutes the reasoning that says that language is transparent. Readers do have to participate in the text; referential texts are less open to interpretation and ambiguity than a piece of fiction, but they are still open. Second, this observation supports the more realistic view of the communication process and communication models in technical writing. Until we accept the fact that there is a reader who has expectations, needs, and failings (perceptual as well as social), the supposed objective nature of technical texts will remain useless and mythical. Writing and its uses in the real world simply do not support this naive view of writing as artifact, as product.

Another view of this same perspective is the position that sees writing as a pure object that exists in some kind of vacuum. The reader is simply not part of the schema of communication. Of course, some of this thinking is informed by the general perception that much which is technical is, in fact, visual in nature. Admittedly that is a valid point when we consider that virtually every study of technical and scientific material indicates that such texts are approximately thirty percent visual. Many companies, particularly international corporations, have even increased that percentage in an attempt to deal with transcultural problems. However, it is hard to escape the needs of a literate and demanding readership.

This situation is also supported, consciously or unconsciously, by the academic and professional societies. The International Technical Communication Conference (ITCC), for example, has offered only a handful of papers on reading, as distinct from readability in over a quarter century of meetings. Most of their offerings have, indeed, focused on sophisticated mechanical crutches that analyze written material in a quantitative fashion. As Merrill Whitburn and S. M. Halloran have pointed out, none of this thinking has done anything constructive to assist ours or the writers' understanding of audience. Instead it has pointed out, and perhaps exacerbated, the tensions that exist in defining who technical writers are and what they are about. ITCC is not the only culprit. The International Reading Association has not even given lip service to audience. In fact, only three papers on college or adult audience reading perception were offered at their 1979 convention. One of those papers was by Anne Eisenberg who has indeed moved into untested territory by exploring the demands of reading scientific and technical material.

What does this lack of interest in the reader say for defining the field of technical communication, and what are the consequences of this information? Succinctly, ignoring the reader violates everything we know about communication and communication models. Even if we use the most common model--Shannon/Weaver--we have a writer, a medium, and a receiver. If we are not concerned with who gets the message we compose and send, then why are we sending it? What are we doing?

One can, of course, try to make the case that technical writing textbooks, indeed, keep audience in mind. I haven't been able to convince myself that this is true. For instance, Mathes and Stevenson go to great

lengths to explore audience levels throughout an organization. What they prove is that you can be aware of those levels, not how to write to them. Walker Gibson, it seems to me, does a better job in both Persona and Tough, Sweet, and Stuffy. Admittedly, both or perhaps all of these approaches are still too subjective. Let me take a few moments to explore an empirical methodology that reaches into communicology, contemporary discourse theory, and even ethics, which I feel, tentative though it is at this point, offers a way for defining audiences, purposes, and by extension, the domain of technical communication with a great deal of precision.

My suggested model combines the work of Charles Osgood, Torgerson and the Princeton Group, Shepard and the Bell Laboratories Research Group, Woefel and the GODI Group; Richard Lloyd-Jones' efforts in primary trait characteristics for evaluating written texts; and finally, William Perry and Lawrence Kohlberg's work on ethical dimensioning. Osgood, Torgerson, and Shepard all propose some variation on dimensional scaling techniques. The flexible measurement system offered by multidimensional scales seems particularly appropriate when dealing with stimuli like words, illustrations, or other abstract concepts. Attempts to predict and explain complex socio-psychological phenomena where stimuli often have many intangible dimensions has created a need for such measurement techniques. Technical communication, which deals with a very specific audience (one is tempted to say social group), can benefit from the application of these measures in two ways. First, the measures, operating through a system of paired coordinate judgements, can be used to identify writing and/or professional conceptions that inform the writer's work. That is, through an interviewing technique, which bears striking similarities to Lloyd-Jones' efforts, the researcher can develop a vocabulary of important issues that the writer uses in both his/her writing and which also forms the basis for judgements about audience. These concepts are then paired and the writer is asked to determine the distance between the entire issue spectrum. What emerges is a pictogram, via computational manipulation, that defines the relationship between a variety of issues. For instance, in a pilot project performed by the GODI Group at Rensselaer Polytechnic Institute (RPI), it was discovered that graduate students in technical writing (as well as participants from academia and industry in RPI's summer institutes) exhibited a great deal of tension about their relationship to humanistic and scientific elements in their education or work. That is, they understood the nature of their work but felt uncertain about its role in relation to technology. Since the study has often been replicated, it would appear that technical writers are not certain about their "supporting" role in relation to the ends of technological activity.

Similar studies can and have been done in the work environment. One such effort looked at writers' perceptions of audience and purpose and created a programmatic model for document preparation in that environment. The study, however, pushed the multi-dimensional scaling concept further than normal. As a corollary to the writer/editor analysis, the research group did a similar analysis of the potential (and in this case clearly defined) users of the document. Even before the work was produced, before anyone put word to paper, it was obvious that there was a lack of fit between writers' perception of audience and audience expectations. That clearly

defined gap in preliminary assessment became the basis for changes in text production. It also became the basis for a new editorial policy. The final part of this particular study involved follow-up observations of both populations, as well as a control group, to establish goodness of fit. The effort proved to be a phenomenal success.

Of course, this study was exhaustive and demanding on the part of the writing group. Not every company has such luxury. In defense of the expenditure of time and energy, it should be noted that subsequent studies of similar situations became much easier to accomplish (and just as productive). Once this kind of semantic mapping is established, then it can be applied in a variety of situations to determine the optimal strategies necessary to alter a particular set of relationships to achieve communication fit. This has been, admittedly, a very sketchy profile of a very complex system. Briefly summarized, the technique calls for interviews of both writer and audience to develop the concepts necessary for establishing a model of communication fit--audience perception in comparison to audience expectations, writers' methodologies in comparison to readers' habits. The output needs to approximate the decoder's capabilities. This method offers an intriguing model for coming closer to achieving such a purpose than simple platitudes about knowing your aidience; and it does so in a way that closely resembles the Lloyd-Jones model, a model that is generally considered extremely effective for assessing written material.

In addition, this dimensional technique admits of comparison with the work of William Perry and Lawrence Kohlberg in ethical development. Both of these figures, working within the framework of dimensional scaling, have created matrices that allow one to use comparative scales to make evaluations of moral and ethical development. Since their system is indeed general, we can apply the technique in a variety of areas. According to their schema, it is possible to make judgements about the underlying nature of the communication task by assessing the evident purpose of the finished document. For instance, language used solely as a tool of production (the process orientation decried earlier in this paper) is seen as a sign or symptom of very rudimentary language use. Language in this sense, lacks development and engagement; it is Kinneavy's transparent text. At the opposite extreme, the other half of the pair, is language used as an analytical tool. In terms of language, words on a page, it is symptomatic of an attempt to understand the reality under consideration--a conscious tool. It is also a sign that language is viewed by both writer and reader, in this context, as a medium for personal growth. To go back to the lowest level for a moment. Language is seen in its simplistic form; it is transparent; it describes situations that are clear cut dualities: good and bad, white and black. Theses situations are textually closed; interpretation is both unnecessary and impossible. It is also a communication situation that rarely exists beyond imperatives. At the other end of the spectrum, we find opaque texts that call attention to themselves as artifacts, art objects, objects of delight. Such texts are open in the most general sense; they invite interpretation and possess substantial and irrefutable ambiguities.

This sense of opposition, I think, is a fundamental premise that underlies much of our thinking about the role of technical writing and the dilemma of humanistically trained writers in a technological profession. In support of engineering's role as producer of artifacts, technical writing has inherited some of the tensions, anomalies, and problems of that role. Engineering, for instance, adheres to the doctrine of objectivity which has generated a variety of writing problems that define the limits of the writer's role--personality, the presence of the author, and a discernible "voice"; objectivity, fair treatment of facts and phenomenon; and linguistic manipulation, using language as a tool to create illusion. For the sake of brevity, I would like to take only one of these issues under consideration in this paper--personality.

Personality, it seems to me, implies the presence of the writer as an identity in a work while objectivity rests on an attitude toward material. One can use the phrase, "I found that the sample weighed 128 grams," without destroying the factual nature of the observed measurement. Such a statement not only identifies the author, it places responsibility and, I suspect, is exactly what makes engineers and others apprehensive about using first person pronouns.

In effect, technical writing maintains two unwritten but implied rules about personality: it is permissible and even desirable to ignore the author's identity, voice, or stance; and the best method for communication is to devalue the individual--as both writer and reader. The consequences of such a position has implications both for communication and ethics. To examine this problem we need to examine the role of the individual in a technological society, the methods writers use to communicate in such a society, and the relation of the reader to technical material.

I would like to suggest that we view the individual in a technological society in Anatol Rapoport's terms of instrumental or intrinsic value. The former simply means that an idea, object, or device has value because it enhances something else that we value; the latter--intrinsic--means being comfortable and alive. One can obviously guess that Rapoport sees the instrumental value as inconsistent with humanistic and ethical concerns: if individuals have only instrumental value to technology, as consumers then they have no value. Lee Thayer offers a similar distinction, which neatly applies Rapoport's terms to our needs, when he discusses the ethical role of communication. For Thayer communication has two possible roles: socialization and individuation. Communication in the former sense relies on people expressing and understanding themselves in the "proper" manner without regard to fact; social "fit" is paramount, nothing else matters. (This sense, for example, typifies scientific agreement about a particular phenomenon.) In contrast, individuation in communication is characterized by language behaviors which see value (intrinsic value) in the individual. Technology, in either view, must be the receptacle of instrumental value, man of intrinsic. Once one agrees to such statements, ethics assume a much more dominant role in technological affairs, including communication.

Along with this revaluation of the individual must also come a reconsideration of the author and reader in relation to technical information.

Herbert Simon, for instance, posits an intriguing definition of a goal-seeking system (of which man is an example) that seems to me particularly appropriate to examining this relationship. Such a system, Simon maintains, has two channels (the old inner and outer environment in some ways): the afferent (sensory channels) which receive information and the efferent (motor channels) through which the environment is manipulated. Interestingly, Simon's observations parallel the work of Louise Rosenblatt who uses the term efferent in her theoretical discussions to describe the concepts to be retained after reading. While this use at first appears to be somewhat at odds with Simon's use of the term, I want to suggest that his efferent channel depicts ways of using the concepts retained by the afferent channel and, as such, both terms describe the same phenomenon as Rosenblatt's term. Rosenblatt, in fact, says that readers direct their response to referential prose outward [afferently in Simon's terms] toward concepts to be retained or actions which are textually determined.

An additional aspect of personality that must be dealt with concerns what Rosenblatt calls "selective attention." In selective attention, Rosenblatt claims that a reader adopts a focus of attention, a stance, and then selects responses relevant to the text based on that stance. She adds that this continuing process bestows interest on particular thoughts which then seem independent of consciousness; at this point the selective process sets the degree of awareness by weighting the potentiality of the text for both efferent and experiential import. The reader has the primary responsibility to manage this weighting process which, in actuality, is based on textual potential for engaging the reader in multiple, selective activities.

This sense of selectivity is at one with the concepts I discussed earlier. Selective behaviors, behaviors which define the ways in which information is actually processed, have the potential to define both the reader's and the writer's relationship to communication tasks. One does not, of course, see communication tasks as simple polarities; it is, however, possible to use this sense of polarity for good ends. One can take such paired opposites, add the element of personal interviews, multi-dimensional scaling, and ethical considerations to provide editors with a fairly descent and replicable definition of both the necessities of the writing task and the demands and expectations of the potential reader. One can also make judgements about the commitment and allegiances of both writer and audience, and, I think, place the field of technical communication squarely into a domain that has carefully defined characteristics regardless of regional aberrations. Unlike other, more subjective systems, this combination of techniques, all of which have a long history of demonstrable accuracy, has the potential for defining the field of technical communication with precision and humanity.

SUGGESTED READINGS

Holton, Gerald. Thematic Origins of Scientific Thought. Cambridge: Harvard University Press, 1973.

Iser, Wolfgang. The Act of Reading. Baltimore: Johns Hopkins University Press, 1978.

Kinneavy, James. A Theory of Discourse. Englewood Cliffs, NJ: Prentice-Hall, 1971.

Kohlberg, Lawrence. "Development as the Aim of Education," Harvard Educational Review, November 1972.

Kuhn, Thomas S. The Structure of Scientific Revolutions. Chicago: University of Chicago Press, 1970.

Laudan, Larry. Progress and Its Problems. Berkeley: University of California Press, 1977.

Lloyd-Jones, Richard. "Primary Trait Scoring," in Evaluating Writing. NCTE, 1977.

Polanyi, Michael. Personal Knowledge. Chicago: University of Chicago Press, 1958.

Rapoport, Anatol. "Scientific Knowledge and the Value of the Individual," Humanitas, 15 (May 1979), p. 199.

Rosenblatt, Louise. The Reader The Text The Poem. Carbondale, IL: SIU Press, 1978.

Simon, Herbert A. The Sciences of the Artificial. Cambridge: MIT Press, 1969.

Thayer, Lee (ED.). Communication: Ethical and Moral Issues. NY: Gordon and Breach, 1973.

Woolfel, J. & E.L. Fink. Science and Human Communication. NY: Academic Press, 1980.

TRENDS IN LIABILITY

AFFECTING TECHNICAL WRITERS

L. P. Driskill, Ph.D.
Associate Professor of English
and Administrative Science

Rice University
Houston, Texas 77001

WHY LIABILITY RATES A WARNING

When most people think of "product liability" they imagine consumer products like "PAM" and hair dye, industrial and agricultural chemicals such as xylene, propane, and malathion, and equipment such as tractors and truck-lifts. In a product liability case the definition of "product" includes more than these easily imagined physical products. Product liability decisions have pronounced defective a wide variety of product components: brochures, catalogue data, price lists, advertising (both mail and periodical ads), care and use books, warranty cards and explanations, instruction manuals, installation manuals, repair manuals, shipping and display tags, labels, nameplates, decals, field assembly and/or installation services, service and maintenance, and spare or replacement parts. Obviously, technical writers are involved in creating many of these product components.

Even this broader picture of what constitutes a "product" does not show all the ways in which writers are involved in the prevention and defense of product liability actions. In a key decision in the case of Barker v. Lull Engineering (1978), the California Supreme Court made two rulings, one of which has special significance for writers:

> "Second, a product may alternatively be found defective in design if the plaintiff demonstrates that a product's design proximately caused his injury and the defendant fails to establish in light of the relevant factors, that on balance, the benefits of the challenged design outweigh the risk of danger inherent in such design." [emphasis added]

The court was explicit: the burden of proof is on the defendant company to persuade the trier of fact that the merits of the design outweigh the risk. As a result, all the documents generated during the products' life cycle--design memos, design tests, clinical trials, trial use reports, letters, proposals, etc.--take on an urgent relevance, because these documents are likely to become the only available means of showing that the product was not defectively designed. These documents will become the evidence that the product underwent balanced and well-considered planning, development,

testing, quality control, and field testing. Thus, technical writers who prepare any of the attending pre-sale or post-sale documents and any technical specialists involved in product design, development and testing can be drawn into the arena of product liability litigation.

The arena is getting bigger, fast. Product liability suits in the United States, which were being filed at the rate of about 50,000 per year in the 1960's, increased during the 1970's to 500,000 a year, and may average nearly a million per year in the early 1980's, according to alarmed estimators. The Federal Government's Interagency Task Force on Product Liability concluded after an 18-month study that these estimates were much too high and that only 60,000 to 70,000 actions went forward annually.

The precise number of cases is probably less significant than the soaring costs of liability insurance. In 1978, manufacturers and retailers paid an estimated $ 2.75 billion for product liability insurance, compared with $ 1.13 billion in 1975. For some companies, insurance rates rose more than 200% in a single year. The panic price jumps by the insurance companies, added to the costs of legal fees and claims have created a crisis among manufacturers. Further, state supreme court judges changed several standards by which cases are judged in a series of precedent-setting cases that have encouraged the filing (and winning) of liability suits, which has in turn driven up costs.

Although the majority of cases are still brought on the basis of a defect in production, more and more cases are filed on the basis of "failure to warn." Plaintiffs' attorneys see several advantages in basing cases on the failure to warn or to give adequate instructions. The plaintiff often can prove his case without the expense of expert testimony and without preserving the physical evidence that is required in proving defects of manufacture or design. Further, the jury is more easily able to grasp the need for better warnings or directions than to understand the claimed deficiency of a complex design or manufacturing process. The defendant company can less frequently claim that the plaintiff had expert knowledge and was therefore guilty of contributory negligence. Thus, with more cases turning on "failure to warn," technical writers will be increasingly involved in the prevention and defense of product liability claims.

As if the expanding number of cases were not threat enough, the duty to warn has been expanded. For example, formerly it was held that a manufacturer or seller was not negligent if he failed to warn of danger that arose in the use of a product in an unlikely, unexpected, or unforeseeable manner [United States, Littlehale v. E. I. du Pont de Nemours and Co. (DC NY) 268 F Supp 791, affd (CA NY) 380 F .2d 274; also, Louisiana, Merwin v. D. H. Holmes Co. (1969, La App) 223 So .2d 878; and others]. Recent decisions have gone the other way. For example, Faberge was held responsible and paid $ 27,000 when a teenager poured perfume over a burning candle in order to scent it. Faberge claimed that it could not have foreseen that the product would have been poured on an open flame, a clear misuse of the product, but the defense was not accepted [Moran v. Faberge, Inc. 332 A .2d 11, 273 Md 538].

Implications of precedents and new laws should be noted by technical writers and watched for further developments, especially by those who contract

to write pre-sale and post-sale documents. The inclination to extend liability suits to include third parties may or may not eventually allow plaintiffs to bring suit against technical writing contractors and consultants. The State of Indiana has provided that a manufacturer can bring anyone who is actually at fault into a lawsuit as a third-party defendant. At present, it appears that employers in Indiana are the ones most likely to be named as third-party defendants, generally for actions leading to workplace accidents, such as unauthorized modification of equipment or failure to transmit warnings delivered by manufacturers. The possibility of being named as a third-party defendant becomes more ominous because of precedents providing that any ambiguity in the language of a warning furnished in connection with the sale of a product is to be "construed against the one who chose the words used." Schilling v. Roux Distributing Co. (1953) 240 Minn 71, 59 NW .2d 907. WARNING: It is time for technical writers to know more about liability.

LEGAL BACKGROUND

The current situation, which law professor A. S. Weinstein has described as caveat venditor--let the manufacturer beware--developed in a series of events over the last twenty years. For a hundred years before that, the situation had been caveat emptor--let the buyer beware--although gradually court decisions began to give buyers some protection. In 1842 a British mail guard riding shotgun was thrown from a coach and injured. When he sued the contractor who had supplied the coach to the Royal Postmaster, claiming the vehicle was defective, his claim was denied on the grounds that he had no privity of contract with the manufacturer. The privity requirement prevented most injured persons from suing manufacturers. The landmark case, MacPherson v. Buick Motor Co. in 1916 and subsequent cases altered the privity requirements and allowed injured persons to sue the manufacturers in some circumstances.

Most important, in 1962 the California Supreme Court set forth a doctrine of strict liability. The court explained that manufacturers are in a better position to prevent the sale of dangerous products than others, and if injuries occur from the use of products, manufacturers are best able to equitably distribute the losses among consumers. Subsequently, strict tort liability doctrine was elaborated in Section 402A of the Second Restatement of Torts, a publication of the American Law Institute. This private organization, made up of lawyers, judges, and professors, had no law-making powers, of course, but most state legislatures have since adopted some form of strict liability as a basis for product liability actions.

Even if a product is designed perfectly and manufactured free of defect, the product can be considered defective and the manufacturer negligent if he fails to warn the users of dangers that may arise in the use of the product. A Colorado court affirmed (1979) that "a product which is free of manufacturing or design defects nevertheless may be defective and unreasonably dangerous if not accompanied by adequate instructions and warnings" Anderson v. Heron Engineering Co., Inc. 604 P .2d 674; similarly in Embry v. General Motors 565 P .2d 1294, 115 Ariz 433 (1977).

LIABILITY PREVENTION PROGRAMS

The implications of "duty to warn" as it arises in product liability suits should be understood by all technical writers and technical professionals who write as part of their ordinary duties within organizations. Writers are in a key position to reduce costs and delays in the production of pre-sales and post-sales documents and to improve the efficacy of all warnings to consumers.

One way that technical writers can assist their companies is heading or participating in pre-accident products liability prevention and control programs, also called products integrity control programs. These programs, aimed at improving the safe design and production of the product as well as the adequacy of pre-sales and post-sales documents, accompanying tags, stamped warnings, and decals, should benefit consumers by creating better products and instructions. They should also benefit manufacturers by reducing the number of accidents and the number of claims by documenting the company's efforts to produce safe, reliable products and to provide proper guidance for users.

Several programs have been proposed, but they have many similarities. The key steps in such programs are summarized in the following excerpt from a report of the Subcommittee on Capital Investment and Business Opportunities of the Committee on Small Business of the House of Representatives, House Rep. 95-997, March 21, 1978, pages 68-69:

1. An explicit company policy concerning product safety, quality control, and risk prevention.

2. Rigorous testing of the program within the context of its use environment.

3. A product loss control committee headed by a person representing top management, who has clear authority to coordinate loss control activities. Members of the committee should include representatives from research, engineering and design, production, quality control, marketing, legal, safety, and insurance departments.

4. Procedures to assure that government standards and regulations which apply to product safety are understood and considered at all operating levels and are used as minimum requirements in product design.

5. Procedures for evaluating the potential for personal injury or property damage during use, or reasonably expected misuse, or products or changes in existing products.

6. Review of existing quality control procedures in relation to developing product liability law. Procedures that are clearly defined, well understood and closely followed.

7. Adherence to quality control and inspection procedures that are systematically documented.

8. Conspicuous posting of warnings and instructions in a permanent form where such information is necessary.

9. Review of all advertising, brochures, labels, warnings, warranties, and instructions by engineering and legal departments to insure that the information provided is accurate, clear and complete.

10. Permanent coding of components in order to identify the source, place and date of manufacture.

11. Systematic procedures for investigating product liability incidents and implementing remedial measures where necessary.

12. Maintenance of records through the expected life of each product, to include information on research, design, tests, quality control, sales, service and ownerships.

Although each one of these "steps" expands into many organizational processes and actions, the summary conveys an overall picture of the concerns of such a program. Articles describing these programs are listed in the bibliography.

Because product integrity or liability prevention requires the collaboration of a wide variety of company specialists, a program can be coordinated by the head of publications as well as by other engineering or production specialists. Most important, the technical writer should realize that he or she is involved in product integrity and product liability prevention whether a formal program exists or not. To reduce the costs of product liability prevention and control, technical writers must understand who must warn, who must be warned, when, and about what, and they must know what criteria will be applied in the evaluation of their warnings and instructions. This article reviews pertinent trends and points out cases to familiarize technical writers with the general but significant aspects of product liability.

WHO MUST WARN

The basic rules that govern the duty of manufacturers or sellers to warn of product-related dangers are set out in the American Law Institute's Second Restatement of Torts, mentioned earlier. The basic rule is that an individual or company supplying a product (chattel) to someone else must warn the buyer:

(a) if the supplier knows or has reason to know that the product is likely to be dangerous for the use for which it is supplied, or
(b) if those for whom the product is supplied are not likely to know that the product might be dangerous, or
(c) if certain conditions might make use of the product dangerous, even if the product is not dangerous in itself.

The supplier is subject to liability for harm caused by the product to those whom the supplier should expect to use it. This responsibility to warn holds whether the supplier provides the user with the product directly or supplies the product through a third person. The responsibility of the supplier extends to those who are not direct users but who are endangered by the product's probable use (such as bystanders, persons in the vicinity, etc.).

The duty to warn does not arise from the status of being a manufacturer or seller, or from the nature of the product, but from the superior knowledge that the manufacturer is supposed to have. A manufacturer is charged with having superior knowledge of the nature and qualities of its products, and is obligated to keep abreast of scientific information, discoveries, and advances pertaining to its business. For example, in Griffin v. Planters Chemical Corporation the manufacturer of a pesticide was determined to be negligent for having marketed a product that had toxic qualities unknown to the manufacturer. The company had not tested the product for toxicity and gave no warning. The label used, although in compliance with the requirements of the Secretary of Agriculture, was held inadequate. A retailer's employee was examining products at a distributor's place of business when a bag of one percent parathion dust burst open and the employee was exposed to its contents Griffin v. Planters Chemical Corp. (1969, DC SC) 302 F Supp 937. Manufacturers formerly were not usually held negligent for failing to warn when the manufacturer had no actual knowledge of the hazardous character of the product (for example, see Briggs v. National Industries (1949) 92 Cal App .2d 542, 207 P .2d 110), but they seem more likely to be held responsible for full knowledge of any dangerous potential now. For example, in a well-known case, Little v. PPG Industries, the appeals court held that "a manufacturer's failure to provide adequate warnings does not depend on manufacturer's knowledge of danger; such knowledge is assumed, and it is failure to give adequate warning that renders product unreasonably dangerous" 579 P .2d 940, Wash. App. 812, modified 594 P .2d 911, 92 Wash. .2d 118 (emphasis added).

Sellers as well as manufacturers many times are bound by the duty to warn. Where the non-manufacturing seller knows or should know that the product is or is likely to be dangerous for the use for which it was supplied, the seller has the duty to warn the buyer. In contrast, if the seller is merely a conduit in the distributive process, for example, selling a packaged product without the package's having been opened, the seller has no duty to warn of a dangerous characteristic of which he knows nothing Crandall v. Stop & Shop, Inc. (1937) 288 Il App 543, 6 NE .2d 685. Non-manufacturing sellers in some circumstances do have a duty to warn; for example, if the seller sells a large quantity of a particular product or acts as a distributor, he has superior knowledge, as in McLaughlin v. Mine Safety Appliances Co. (1962) 11 NY .2d 62, 226 NYS .2d 407, 181 NE .2d 430. And if the seller knows of the dangerous qualities of a product and also knows that the label or name of the product does not adequately convey knowledge of the danger to the buyer or to the public, he has a duty to warn Bower v. Corbell (1965, Okla) 408 P .2d 307; and Jones v. Hittle Service, Inc. (1976, Kan) 549 P .2d 1383, 219 Kan 627. And if the seller repackages, modifies, or alters the original product, he has a duty to warn.

In a 1979 case, the court affirmed the finding of the trial court, and dismissed the appeal, concluding that the doctrine of superseding or intervening cause was particularly appropriate "when the intermediate buyer is a large industrial concern with its own safety programs and method of product distribution and where the manufacturer may have no effective means of communicating its warnings to the ultimate users" Reed v. Pennwalt Corp. (1979

Wash App) 591 P .2d 478, 222 Wash App 718, affirmed and appeal dismissed, 604 P .2d 164, 93 Wash .2d 5. However, when the intermediate customer is not in a better position to pass on the information, giving notice to the seller is not enough. In Shell Oil Company v. Gutierrez, 581 P .2d 271 (Ariz App, 1978), it was determined that Shell had a duty to warn a welder of the danger of explosion from an empty drum of liquid xylene which had been used by an intermediary seller, Christie Oil Company, who repackaged the product in 55 gallon drums and affixed only a flammable liquids symbol on the top of the drum. The court affirmed the jury verdict for the plaintiff:

> ". . . whether a warning beyond the manufacturer's immediate vendee is required in a particular case depends upon various factors. . . . Among them are the likelihood or unlikelihood that harm will occur if the vendee does not pass on the warning to the ultimate user. . . and the ease or burden of the giving of warning by the manufacturer to the ultimate user. . . . Shell failed to adequately warn Christie or Flint of the danger of explosion, the possible precautions, or the type of labeling that would be appropriate."

Professionals, such as physicians who recommend the use of a product, select the product on the basis of superior knowledge, and are responsible for warning clients of product hazards. But if a manufacturer suspects that no professional will intervene who is capable of warning the user, then the manufacturer must supply warning labels and instructions, as in products supplied for large scale injection or immunization programs.

WHO MUST BE WARNED

Certainly, no duty to warn exists where the product is not dangerous or likely to become dangerous in an foreseeable use or circumstance. No duty to warn exists where the danger is obvious. The court dismissed the complaint when Valerie Brown sued Tennessee Donut Corporation after sipping hot coffee from a styrofoam cup and burning her lip and spilling coffee on her leg. The danger that freshly served coffee may be too hot to drink is an obvious danger. Obviousness is usually a matter of the age and experience common to persons similar to the injured person. However, where there is a difference of opinion over the obviousness of the danger, the degree of obviousness presents a question of fact.

One class of users need not be warned, regular users of the product and those whose professional education, training, and experience have given them expert knowledge of the danger. For example, in Hamilton v. Hardy (1976, Colo App) 549 P .2d 1099, 37 Colo App 375, the court said that plaintiff could not complain that he did not receive from the manufacturer and retailer instructions and warning regarding matter which, by reason of his own prior experience, he understood and appreciated. However, manufacturers must estimate carefully the level of knowledge users will have. But in Griggs v. Firestone Tire and Rubber Company 513 F .2d 851 (8th Cir. 1975) a workman who was securing a wheel to a truck suffered permanent injuries when a tire and rim assembly exploded. The defendant argued they "assumed that most people servicing its rims would realize the dangers and possess the requisite aptitude

and experience to assemble the rims safely." In this case, the rim components of the wheel had been mismatched at an earlier time. The need to match parts properly was described in Firestone catalogues, but many local service stations did not have these catalogues. The court disagreed with the company, and recommended that a warning be stamped directly on the product. The expertise of users and the availability of warnings to experienced users should always be considered.

In general, those who must be warned are those who rely on the superior knowledge and advice of the manufacturer or seller and persons who cannot inspect or test the safety of a product (see William Cronen v. J. B. E. Olson Corp. (1972 Cal) 104 Cal Rptr 433 App & E 989). Those in danger, even if a small fraction of the public, must be warned.

One trend that seems to be developing is the substitution of a stricter standard of care in regard to those warned. In Tampa Drug Co. v. Wait (1958 Fla) the court pointed out that "implicit in the duty to warn is the duty to warn with a degree of intensity that would cause a reasonable man to exercise for his own safety the caution commensurate with the potential danger," and added that it is the failure to exercise this degree of caution after proper warning that constitutes contributory negligence, 103 So .2d 603, 75 ALF .2d 765. More recently, the "prudent man" standard has been substituted for the "reasonable man." Prudent persons, being more concerned about making protective judgments, require a more detailed warning and warning about less likely or less severe hazards in order to give themselves greater protection. For example, in Hubbard-Hall Chemical Co. v. Silverman the court ruled that "adequate warning . . . is one calculated to bring home to a reasonably prudent user of a product the nature and extent of the danger involved" 340 F .2d 402 (1st Cir. 1965). In this case the defendant's label, which was approved by the Department of Agriculture, was not satisfactory and the court admonished that "there is no authority that by obtaining governmental approval the defendant had met the possibly higher standard of due care imposed by the common law of torts . . . ." The substitution of the "prudent man test" for the "reasonable man test" has occurred in other areas of professional services, such as accounting, law, and medicine, and appears to be a trend in product liability as well.

Finally, one other trend is changing the population of persons who must be warned. Recent decisions have extended the duty to warn to include illiterate persons, children, and persons who do not speak English. The claim that the user is illiterate is no longer a defense for the adequacy of a warning. In Hubbard-Hall Chemical Company v. Silverman, the court also emphasized that "the defendant should have foreseen that its admittedly dangerous product would have been used by, among others, persons like plaintiff's intestate, who were farm laborers, of limited education and reading ability, and a warning, even if it were in the precise label submitted to the Department of Agriculture would not, because of its lack of a skull and bones or other comparable symbols or heiroglyphics, be adequate instructions or warnings of its [parathion's] dangerous condition." In earlier cases, such as S. C. Johnson & Son, Inc. v. Palmieri (1958, CA Mass) 260 F .2d 88 the courts held that the trier of facts was entitled to assume that the plaintiff could read. Other cases have demonstrated that graphics if not multi-language warnings must be used to convey severe hazards to children, their parents, and persons who do not speak English.

WHAT DANGERS MUST BE EXPLAINED

Three questions are specially important in determining whether a hazard exists about which the supplier must give a warning:

1. How likely is it that an accident will occur when the product is used in more or less the expected manner?

2. How serious an injury is likely to result?

3. How feasible is it to give an effective warning?

The decision to warn involves these questions plus the standard of due care that is applicable in the situation. In general, Kenneth Ross advises companies that suppliers should warn against: "a. An inherent danger in the product which is impossible or difficult to avoid (e.g. drugs); b. A danger that can be avoided if certain precautions are taken before or during use of the product (e.g. poison, flammable material); c. A danger that can be avoided if instructions as to proper methods of use are followed" ("Pre-Accident Prevention of Liability: Manufacturer's Products Liability Prevention Programs," in Prevention and Defense of Manufacturers' Products Liability (1978)). In addition, warnings must also be given when a foreseeable circumstance or unintended use could cause danger.

The extent and severity of the hazard must be explained, so that the user will have adequate notice of the possible consequences of use or even of misuse. The standard has been vividly expressed in Post v. American Cleaning Equipment Corp.: "As an example, it may be doubted that a sign warning, 'Keep Off the Grass,' could be deemed sufficient to apprise a reasonable person that the grass was infested with deadly snakes. In some circumstances a reasonable man might well risk the penalty of not keeping off the grass although he would hardly be so daring if he knew the real consequences of his failing to observe the warning sign. Or, a warning to 'Keep in a Cool Place' might not be sufficient if the result of non-observance was a lethal explosion of the container" (1968, Ky) 437 SW .2d 516. Potentially hazardous deviations from expected use must be declared so that serious consequences may be avoided. Thus, suppliers must now expect to warn against:

a. dangers associated with expected uses of the product, especially all hidden or non-obvious dangers
b. all accidents that might develop through unforeseeable use (because of some property of the product, e.g. flammability)
c. all accidents that might develop through foreseeable misuse (e.g. warning against using lawnmower to trim hedge), and
d. modification or hazards resulting from improper maintenance or repair.

The overall effect of these changes is to require a more thorough and comprehensive effort to warn of all suppliers.

WHAT MAKES A WARNING ADEQUATE

Specifying what makes a warning adequate is more than moderately difficult, because many case decisions affirm that adequacy is a matter for the jury to decide. For example, in Burch v. Amsterdam Corp. (1976 DC App) the appeals court declared that "sufficiency of a particular warning by a manufacturer or seller of a product as to risks involved in the

use of such product is ordinarily a question for the jury" 366 A .2d 1079. Not only is adequacy a matter for the jury to decide, the court need not furnish guidelines to the jury, although some do so: "In strict products liability case, trial court may rule as a matter of law that warnings are inadequate when, and only when, danger is clearly latent and in all other cases, adequacy of both content and prominence of warnings accompanying a product is a question for the jury, and court need not furnish guidelines to aid jury in its determination" Berry v. Coleman Systems Co. 596 P .2d 1365, 23 Wash App 622. The latitude of the jury thus becomes one of the many variables that the technical writer must keep in mind when trying to prepare an adequate warning. What a Virginia jury will consider adequate may not suit the criteria deemed appropriate by an Oregon jury. Thus, no absolute standards can be recommended.

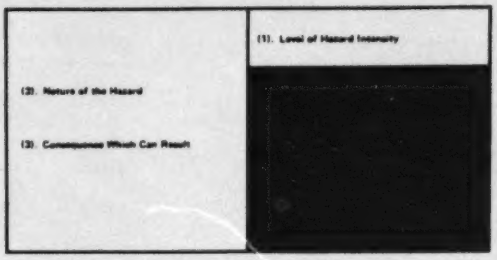
Several federal agencies control the language and format of certain labels, for example: Consumer product Safety Commission, 16 C.F.R. 1500.121 et seq. and 42 Fed. Reg. 23,052 (1977); Environmental Protection Agency, 40 C.F.R. 162.10; Occupational Safety and Health Administration, 29 C.F.R. 1910.145; Nuclear Regulatory Commission, 10 C.F.R. 20.203. The fact that the requirements are established by regulation, however, does not ensure that compliance will be deemed adequate to fulfill the supplier's duty to warn, as was noted earlier in Hubbard-Hall Chemical Company v. Silverman and in Griffin v. Planters Chemical Corp. Because each regulation is limited to a single industry, product, or situation, overlapping standards can cause problems for writers. In general, technical writers should check with the company counsel or with an expert in liability law to determine which regulations are likely to apply to the company's products. After that, the technical writer should apply his own knowledge of liability in devising warnings that meet the most extreme case and the least able user's needs and have the warnings reviewed by the products integrity committee.

The basic test that a technical writer might apply would demand that a warning tell the seriousness of the risk involved, explain the kind of risk in a way that the reader will understand it, tell how to avoid the risk, and command the attention of the user at the point of use. Other writers have recommended that warnings be accurate, fair, strong and clear, plain, readily noticeable, timely, and actually communicated. Inasmuch as a jury may be able to emphasize or ignore any one of these, this series of standards must only be taken as a tentative guide. The decisions in some cases indicate how such standards may be interpreted.

Sufficient to command the user's attention at the point of action. Recent cases have caused the courts to elaborate on the ability of the warning to make an impression on the mind of the user at the point of action. In Shell Oil Co. v. Gutierrez (1978 Ariz App) the court commented that whether the warning given was adequate "depends on language used and the impression that it is calculated to make upon the mind of the average user of the product" and noted that "adequacy of the warning label on the product is not determined solely by reference to words on the label but also by reference to physical aspects of the warning, such as conspicuousness, prominence and relative size of print; all of such physical aspects must be adequate to alert the reasonably prudent person" 581 P .2d 271. And in Little v. PPG Industries, Inc. (1979 Wash) the finding was that "the applicable question is whether the warning was sufficient to catch the attention of persons who could be expected to use the product and was sufficient to apprise them of its dangers and to advise them of the

measures to take to avoid such dangers" 594 P .2d 911. A concerted effort may be required from writers, designers, graphics specialists, and psychologists trained in human factors engineering in order to determine the proper placement of the warning. Sales representatives and buyers' purchasing agents might also contribute information about the likely use and workplace conditions in which the product might be used.

Appropriate and commensurate to potential danger. Bowen H. Tucker's analysis of product hazard communications provides a useful example of a method for integrating graphic and verbal elements of warnings. He recommends the integration of written communication and pictorial or symbolic representations to alert the broadest range of possible users. His system of presenting warnings calls for showing in the warning (1) the level of hazard intensity, (2) the nature of the hazard, (3) the consequences that can result if the instructions to avoid the hazard are not followed, and (4) instructions on how to avoid the hazard. He advocates a standard system of warnings and representations, something like the international driving symbols, that could be used to warn national and even international purchasers. His system warns of three levels of hazard intensity: danger (immediate hazards which WILL result in severe personal injury or death); warning (hazards or unsafe practices which COULD result in severe personal injury or death; and caution (hazards or unsafe practices which could result in minor personal injury or product or property damage). An example of his formats and warnings follows:



Cooperation with other specialists in the product integrity program team and testing of warnings and manuals before adoption. Making the writing of warnings and other product components part of a systematic effort to ensure product integrity has many advantages for technical writers. Better information about hazards will be available to the writer; better advice about new developments in liability litigation can be obtained from the firm's legal counsel; assistance from the graphics division can improve the ability of warnings to command the attention of users; and more adequate records of the company's efforts to balance the hazards of designs against their merits will be available in the event of liability actions. One further objective can also be accomplished. At present, the adequacy of any warranty, instruction manual, or label can be undermined if the jury decides that the user was lulled into false expectations about the safe use of the product by misleading advertising. For example, if the advertising for a product claims that it is "equipped with fail-safe

brakes" and the brakes subsequently fail, a well-written warranty may be breached and the plaintiff may collect. The unified action of the entire group of persons involved with product integrity can lead to the elimination of inconsistencies in product literature as well as to the prevention of accidents.

FUTURE RESPONSIBILITIES

Technical writers, as the group of persons who "choose the words," should expect to lead efforts to improve the quality of the many product components that are delivered to the consumer in written form. To provide this leadership they must become familiar with the pertinent regulations, with the standards of voluntary associations, and with trends in liability litigation. New laws, patterned after models such as those created by the American Law Institute or the federal uniform product liability law announced by the Department of Commerce and introduced by Representative Preyer of North Carolina as H.R. 7921 but not passed during the last session of Congress, may affect the criteria that warnings and other written product components must meet. No single source or magic touchstone is known. Technical writers will have to face a responsibility similar to that confronting every jury determining what language and notice will be sufficient to command the attention of the actual users of a product under the full range of possible circumstances in which the product may be used and to give them clear notice of the necessary action to keep themselves safe from harm.

SELECTED BIBLIOGRAPHY

Dillard and Hecht, Product Liability: Direction for Use and the Duty to Warn, 41 Va. L. Rev. 145 (1955).

Restatement of the Law, Second Torts .2d, The American Law Institute, 1976.

Hursh and Bailey, American Law of Products Liability .2d, New York, 1974.

Noel, Products Defective Because of Inadequate Directions or Warnings, 23 SW L. J. 256

Prevention and Defense of Manufacturers' Products Liability, Kenneth Ross, Chairman, Practising Law Institute, New York, 1978.

Product Liability of Manufacturers: Prevention and Defense, Kenneth Ross and Martin J. Foley, Cochairmen, Practising Law Institute, New York, 1979.

Articles on Liability Prevention: W. Jacobs, "Impact of Products Liability Verdicts on Engineering Management Procedures," Tr Law Guide 19:1-24 (1975); Peter N. Sheridan, "Pre-Accident Prevention of Liability: Manufacturers' Products Liability Prevention Programs," in Prevention and Defense . . . listed above, pp. 49-120; also Bowen H. Tucker, "Product Hazard Communication," in the same volume, pp. 121-228.

HOW DO TECHNICAL AND NON-TECHNICAL PERSONNEL COMMUNICATE?

June Ferrill, Assistant Professor
Department of Languages
Houston Baptist University
Houston, Texas 77074

In an industrialized nation which depends on highly technical information, communication occurs across various strata among experts and among experts and lay persons. Many persons with both technical and non-technical backgrounds spend much of their time writing in technical fields. One of my first experiences as a writer (with a non-technical background) occurred in the marketing department of Texas Instruments. I often had to discuss a project with an engineer in order to write about it. I often found communications between us difficult. This experience has led me to ask several questions. How do technical writers view the writing process? Do persons with technical backgrounds view the writing process differently from those with non-technical backgrounds? How do technical and non-technical personnel communicate with each other? Could I discover an interview model which would facilitate communications between technical and non-technical personnel?

To investigate the writing process I interviewed 15 persons who spend much of their time writing in technical fields. Of the 15 interviewed six have degrees in technical fields such as organic chemistry, medicine, and engineering. The other nine had non-technical degrees in such areas as education, journalism, English, and other liberal arts degrees. I asked those surveyed questions about the writing process, with special emphasis on the pre-writing phase. I wanted to find out what they perceived as their main concerns and their main problems. I also listened to three interviews between writers with non-technical backgrounds and engineers. From these sessions I drew conclusions about the types of information which a writer is often trying to obtain from consultations with technical experts, which allowed me to draw a model of questioning procedures.

The writing performed by persons interviewed falls into two categories. In one category the purpose is instructional or informational, including technical procedures for installation or use of equipment, diagnostic procedures, and product descriptions. In the other category the purpose is motivational, implying that some action is to be taken by the audience. This category includes financial and sales reports, administrative reports, and brochures. As the table below illustrates, the writers with technical degrees write instructional-informational material while those with non-technical degrees are divided between both categories. Personnel interviewed write in either one category or another;

Table 1 — Writing Categories of Personnel Interviewed

Type of degree	Informational	Motivational
Technical	6	0
Non-technical	4	5

there is no cross-over. Of the 15 whom I interviewed, it seems that those with

non-technical degrees may be able to find writing jobs in more diverse fields. Those with technical degrees seem to be placed more often in jobs which require writing in the areas of procedures or product descriptions.

My first question was whether technical writers use written resources or interviews with experts most often in gathering and understanding material to be written about. Written resources include manuals, drawings, encyclopedias, and articles. Experts are defined as those who have technical degrees in the areas in which they work. The table below illustrates that both technical and non-technical personnel involved in writing rely on written material more than interviews with experts.

Table 2 Resources Used Most Often in Pre-Writing by Personnel Interviewed

Type of degree	Interviews with Experts	Written Material	Both Used Equally
Technical	0	4	2
Non-technical	2	4	3

None of the writers with technical backgrounds could say that they use interviews with other experts most often in their writing, although two said that they use experts and written materials equally. One scientist revealed that it was often difficult to get scientists to consult with each other because of the fear that their ideas would be used by someone else. A highly specialized medical doctor involved in heart implant research said that although he did consult with others in his field, it was difficult to communicate with persons whose expertise differed very much from his own. One engineer confided that he had difficulty in following the "buzz words" of engineers in a different field. Even those with technical backgrounds have difficulty communicating with other experts, even if they are in related fields.

Of the non-technical people, the two who depend most on interviews with experts write in highly specialized fields. One writes computer program manuals; the other writes instruction manuals for the use and installation of oil-field equipment. These persons are dependent on the experts for explaining the procedures and for editing for accuracy. Both write for audiences who do not have the expertise of the persons who designed the programs or equipment. These two technical writers feel that it is an advantage not to have a degree in a technical field. Because they are lay persons, they feel that they can identify with their lay audiences and anticipate answering any questions which the audiences might have.

Both the technical and non-technical personnel mentioned the same difficulties in consulting with experts. Arranging time for an interview seems to be a major problem. One writer said that she often had to resort to showing engineers that meeting with her was to their advantage, since manuals had to be ready before the products which the engineers had designed could be shipped. She also appealed to their empathy by informing them of her deadlines.

Writers had the following difficulties in discussing projects with experts:

understanding experts' vocabulary
understanding methods and procedures explained by experts
establishing mutual respect
writers realizing their lack of knowledge in an area

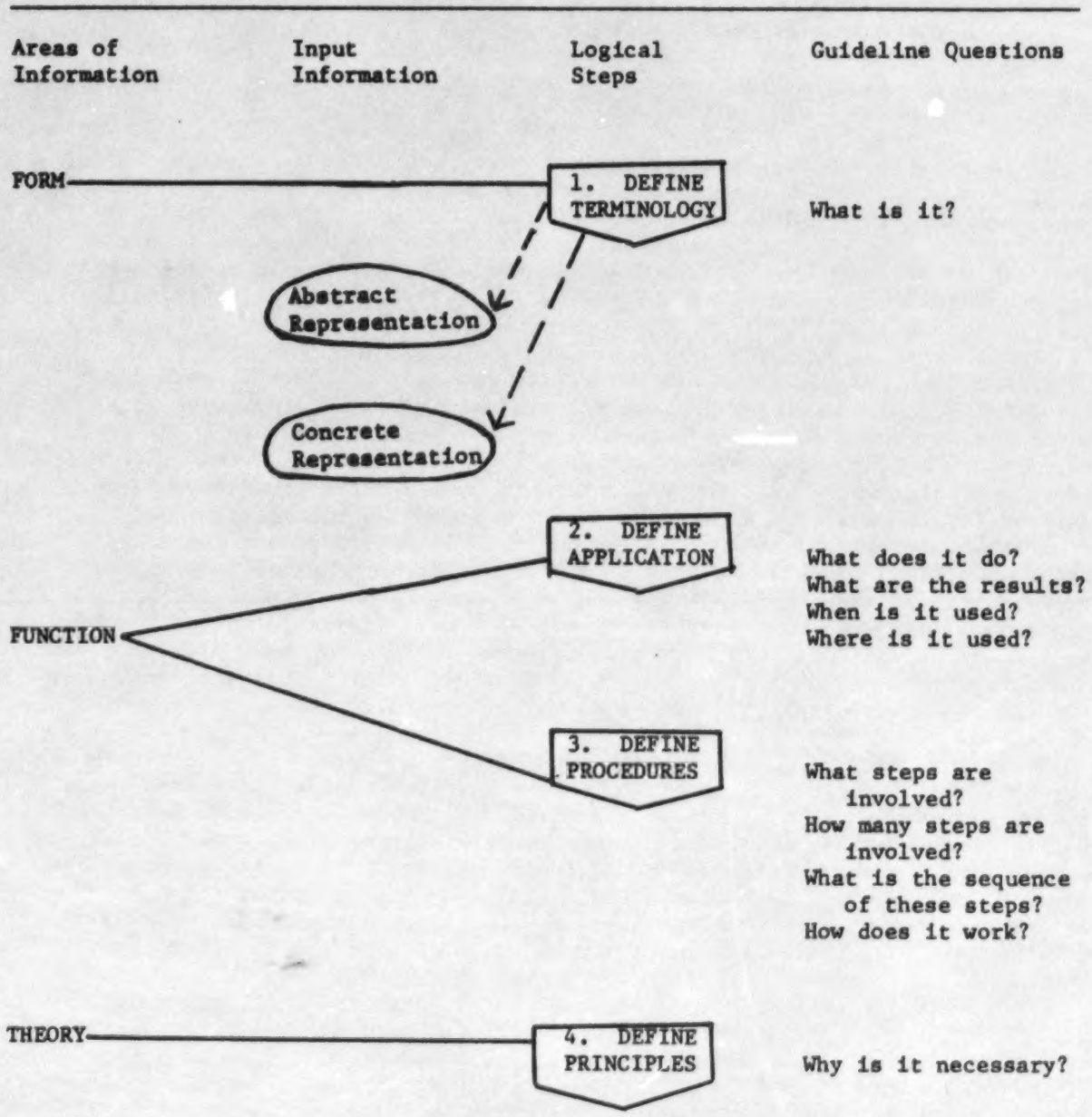
In learning vocabulary, methods, and procedures, writers consult manuals, drawings, specialized reference books or other writers in their departments. If the material they need is undocumented, they have to go to the experts in the field. As I have already mentioned, difficulty with vocabulary is not restricted to non-technical people. One general practicioner in medicine said that he had difficulty understanding the vocabulary of other specialists in medicine.

In building respect from experts writers endeavor to learn as much about a technical area as possible, reading manuals and books. Writers with non-technical backgrounds seem torn between trying to conceal their lack of knowledge and asking questions to gain a clearer understanding. One writer told of a problem which he often encounters in dealing with engineers, "They [engineers] think that you understand their explanations immediately." I suspect that part of the reason for engineers believing that non-technical persons understand immediately occurs because lay persons do not reveal that they do not understand, fearing that they will lose respect. Another reason for non-technical writers neglecting to get all the information needed is that they have not identified what they need to know. Often they have a vague feeling of uncertainty about the material, so they arrange consultations with engineers without clearly organizing the questions which they need to ask.

One interview session which I attended between a writer with a non-technical background and an engineer illustrated that the writer thought he needed to ask one question, but in fact he needed the answer to another one also. He began the interview by asking about the sequence involved in installing two pipes. The engineer gave him the specifications on the two pipes: one 5" in diameter; the other 9". One pipe was to be installed inside the other. The writer had not realized that the main problem was his not knowing the dimensions. Once he knew the dimensions, the sequencing was clear.

The writers interviewed who often consult experts find that they have difficulty controlling the interview. The writers would start with a specific question. This question would be answered by the expert, but then he or she would often begin to elaborate upon the equipment while the writer simply took notes. After the interview the writer would try to decipher his or her notes and determine if they contained what was needed. This type of interviewing often leads to the need for further interviews to obtain all the necessary information. If the writer controlled the interview, time could be spent more efficiently.

Figure 1 Elements of Understanding Technical Material



In talking with writers with non-technical backgrounds, I found that most of the questions which they want experts to answer fall into a few categories: terminology, application, procedures, and principles. I have devised a model (Figure 1) which consists of the elements needed for understanding technical material, especially that material which consists of procedures or product descriptions. Along with the types of input (such as terminology) I have written questions which pertain to these specific types. The types of input are arranged in a sequence beginning with terminology and ending with principles. If the writers use this model as a basis for interviews with experts, asking questions about any categories which writers realize that they do not understand, they might have better results. Such a model would help writers to identify areas in which they need clarification. This model provides a systematic approach to information gathering.

In learning terminology, the writer may become familiar with either an abstract representation (drawings, verbal definitions) or a concrete one (actual equipment). The terminology portion may be the one which writers can most readily learn without having to consult someone else. Whether writers have to rely on written material or consultations, they must ask the question "What is it?" before they can proceed to further understanding of the material. In discussing terminology with experts they may have to ask for comparisons with known objects or known procedures or they may have to ask experts to make crude drawings so that the objects can be visualized.

In writing about equipment, writers should take any available opportunity to actually view the equipment. One writer told me that he had attended maintenance seminars to view the equipment and learn applications. Another said that he visited the stockroom to look at parts. Viewing the equipment makes the concept of form more realistic in terms of contours and dimensions.

The next step after understanding form is understanding function. This step consists of two parts: application and procedures. Application is learned when the writer pursues the question: "What does this do?" To understand procedures the writer must ask questions relating to "how." He or she must ask for steps involved and sequence.

To completely understand an object or process, the writer should understand the principles involved. One writer told me that if he could understand the laws of physics involved he could more readily understand the process. Most non-technical persons interviewed are not concerned with this level of knowledge. But if writers understand the underlying principles, "the why's" of application and procedures, they would have an overview of their subjects which would allow them to see the logic involved.

If the writer uses this model he or she should be more able to define the areas in which he or she needs further knowledge. Using such a model as an interview schedule should provide more control of the interview and a checklist of the understanding needed.

The last area which I looked at in my survey had to do with the primary concern of writers after they had gathered their information. Table 3 illustrates the concern which writers thought of most often in the pre-writing phase.

Table 3 Primary Pre-writing Concerns of Personnel Interviewed

Type of degree	Purpose	Audience	Organization
Technical	6	0	0
Non-technical	1	7	1

Technical personnel were not only more concerned with purpose than were non-technical personnel, they also mentioned that establishing purpose was often a problem for them. They had difficulty in focusing their content. Technical personnel may have difficulty with purpose because, to a large extent, they do not consider audience; purpose is a natural outgrowth of the needs of the audience. The technical personnel interviewed write only for technical audiences and they write informational material. They assume that the audience has the same expertise that they have. Three non-technical personnel who write informational material are concerned with audience. They are concerned with the informational needs of the audience, with anticipating questions and with simplifying material.

Of the writers whom I interviewed only those with non-technical backgrounds write motivational materials. Writing motivational materials requires a concern with audience. Only one writer of motivational materials is concerned with purpose; all the others are concerned with audience. The one concerned with purpose has few ways of knowing her audiences directly; she is a free-lance writer of promotional materials for various clients. The other writers of motivational materials write with an audience response clearly in mind. They are trying to sell a product or gain consent and build enthusiasm for a project. They are concerned with persuasive tactics, so they are aware of their audiences' needs, prejudices and levels of expertise. Awareness of the audiences' needs provides a guide to purpose and focus. These writers, all non-technical, realizing the needs of their audiences, understand that their rhetorical tasks are either to recommend or request or explain, etc. Concern with audience seems to lead to fewer difficulties with establishing purpose and focusing written material.

I have tried to provide a summary of the primary pre-writing concerns of fifteen technical writers. Although this sample is too small to be conclusive, it does show some trends. I have compared the pre-writing concerns of writers with technical and non-technical backgrounds. I have reached the conclusion that ability to relate to audience is of primary importance and that non-technical personnel are more aware of this consideration than are technical personnel. Those writers who interview experts as part of their jobs find that these experts have difficulty relating to writers' needs and levels of expertise. By using a model of elements involved in understanding technical material, writers can probably control their informational needs more adequately. Using this model to control the interview with technical experts, the writer can make these experts more aware of his or her needs as a writer. Conversely, if the writer focuses on the audiences' needs, he or she has little trouble in establishing purpose in writing.

A PROBLEM OF IDENTITY:

WHO ARE YOU WHEN YOU'RE BEING WELL PAID FOR IT?

Lynn B. Squires
Legal Writing Associate
School of Law
University of Washington
Seattle, Washington 98105

I. Mental Set of English Teachers (Why not Professors of Composition and Rhetoric?

An English teacher who puts on the consultant's hat may be surprised, unpleasantly, at how unnatural it feels. The unnaturalness has numerous causes. A few of those causes and a few possible solutions to the self-identity problem are briefly discussed in this paper.

First, the "mental set" of the English teacher is not well suited for consulting work. People who teach composition, whether in secondary education or at the college level, think of themselves as English teachers: the grey-haired "battle-ax" we all dreaded as school children. We rarely think of ourselves as rhetoricians, composition specialists, or as professors of composition and rhetoric. We must describe ourselves in new ways if we are to do new work.

Like other professionals, we value ourselves, at least in part, according to what we are paid. And we are grossly underpaid. When I teach at a local community college, my wage per class hour is $18.00. If I spend five hours for each class hour, for a total of six hours of work, I earn $3.00 per hour--below the minimum wage. If I spend less than five, my students do not learn as much as they should, nor do I teach as well as I could. To earn a living at this rate of pay requires working nights and weekends, without overtime pay, of course. These conditions naturally color our image of ourselves.

Because we have grown accustomed to being underpaid and overworked, we expect nothing else. We even compete fiercely with one another for the opportunity to be overworked and underpaid. I once competed with several hundred other recent Ph.D.'s for a guaranteed "burn-out" job in an unscenic location which would have paid me $11,000 a year. Why did I waste the stamp? The job shortage in our profession has made fools of some of us. We do what no self-respecting garbage-collector or pipe-fitter would ever do: we work

for nothing.

Those of us who finished degrees before the current wave of specialization in composition have an additional strain on our self-images. Although we have experience teaching writing--and experience is finally what counts--we are not equipped with the latest jargon in our field. We are not armed with readability tables and psycholinguistic theories--at least not last month's versions. We lack the mystique of the incomprehensible specialist.

All of this is compounded by certain invisible economic barriers that hold us back. Our aims are low. We hope some day to make as much money as our colleagues who have been at it for twenty years: maybe $20,000, just before we retire. The upper limit in our economic universe is the salary of our chairperson: perhaps $25,000. In a larger department, perhaps $35,000. Many will try for $30,000, few will ever receive it. So we look upwards a very little.

To a significant extent, our future is limited by our short sight. We confine ourselves. What we cannot imagine, we are not likely to achieve. What might we imagine?

II. The Basis For A New Self-Image

We might see ourselves in a broader context, a larger, more prosperous world, as an essential factor in U.S. business and industry. We have a skill, honed by years of drudgery, that business and industry needs and does not have. There is more work to be done outside of our academic institutions than inside of them. And we could be paid more for it outside of them, than inside.

In terms of absolute cost, we are presently teaching writing in the least expensive way--in colleges and universities where the public bears a large part of the expense and where we are willing to work long days for small salaries. Outside of this nonprofit sector, this protected environment, our services have a greater absolute cost--and thus a greater value to us. If I spend one hour with a practicing lawyer and charge $50 (a moderate figure), that lawyer will think it is a bargain (because his hourly rate is higher). I will think it is a bonus because my university pays me an average of $10 per hour for my work with law students. The economic picture is not so simple as that, of course, but it's safe to say that our work is worth three times more outside than inside of our academic institutions.

III. Some Principles of Successful Consulting

How do we harvest that profit? Choose a business or industry compatible with your interest or experience. The more familiar you are with it, the more effective your work will be. The key here is to know the "terrain" before you travel over it. Every business, industry, and profession has its own kinds of written communication, its own language, and to some extent its own style of writing. Offer your services only after you know exactly what you would be working with and what specific help you can offer.

Try to identify communication problems that are commonly complained of within the business or profession. This might be done by simply asking people

who work within an organization to tell you what their communication problems are. Acquire copies of typical written work. Map out the lines of written communication: Who assigns writing tasks? Who writes? Who receives? Who edits? Who proofreads? Who types? Who reads? Who complains about ambiguity or clarity problems? How are such complaints handled? How much time do the writers have? What type of mechanical assistance do they have (word processor, dictating machines)?

When you have mapped the terrain, then decide how to approach it. First attempt to solve the communication problems currently complained of within the organization. Then address the other inefficiencies in written communication that you, with your special expertise, perceive and can solve.

As you research, pay attention to what people inside the business or profession charge for their work or are paid by their companies. Discover what the hourly rates or salaries are of the people you wish to work for. Discover what they pay other consultants. Set your hourly rates according to the "going rate" in that business. Be careful not to undercharge. To some extent, people value services according to their cost. If you charge too little, your work may be undervalued. Of course, if you charge too much, you may have no work. The problem is obvious: once you have set an hourly rate, it is hard to increase it, and it may be too late to decrease it.

If you are charging enough--which from an English teacher's point of view may seem to be a great deal--you will want to offer "full value." This may lead to offering too much. When working outside of your own field, you must simplify. Concepts and approaches must be simplified. Terminology of the grammarian must be carefully defined, perhaps even omitted. Begin at the beginning: Outside of our field, people do not necessarily know the difference between "good" and "well" and probably do not know how to locate the subject and verb in a sentence or how to distinguish between restrictive and nonrestrictive phrases and clauses. Normally, a "lay" audience will not know the difference between a phrase and a clause. So begin at the very beginning. Do not try to impress your audience with technicalities or with the latest findings of psycholinguists and researchers in readability. You may want to toss a term or two in for "window dressing," to establish your "credit" as a specialist, but do not try to teach anything with such language. When you begin your real work, keep it simple and practical.

I do not mean to suggest that creating an "aura" or "mystique" is a waste of time. The contrary is true. You must have what Artistotle termed "ethical appeal" if you are to succeed. Consulting success depends on image as much as on expertise. Above all, you must sound "correct," you must speak grammatically, and you must communicate clearly in writing and orally. You must in your own articulation serve as an example of what you are "selling." But there are two phases to a consultant's work: the first is selling oneself--the "image"; the second is providing a service--the "expertise." In the second phase, always simplify, that is, try to teach a few basic things well.

IV. How To Establish Credibility

Before you have the opportunity to teach a few basic things well, you must get the job. Consulting work depends on "credibility." You must establish a reputation outside of your field. How might this be done?

Institutional service is one way to begin. Most colleges and universities offer lectures on a wide range of topics. A list of faculty members willing to lecture as a public service is kept somewhere, perhaps in an office of lectures and concerts. Add you name to the list. Even though you will not be paid directly, you will enhance your academic reputation as well as reaching out into the non-academic world. If you wish to work in a business or profession, contact the continuing education personnel in the appropriate department or school in your institution. If you contribute to a seminar as a panel member, for example, the notice that will be mailed to alumni and interested parties will provide free advertising for you. If a business school advertises your name in this way, for example, you will have established a measure of "credibility" without much effort, and no cost. Then, of course, you must perform well. That in large part (as discussed above) depends on knowing your audience.

Another way to begin is to investigate continuing education programs within a business or profession. Workshops are regularly offered in nearly every field of work. Good speakers and useful topics are hard to find. Our topic is in vogue at present; it enjoys a cyclical popularity, which is currently at its height. If you do find yourself on a panel for a lecture series or workshop, you may discover that what you have to say is the most useful part of the entire program. Since you will probably be the "odd speaker," that is, the only "lay" person on a panel, you will have built-in "visibility." This can be a tremendous advantage. Here again, while you will probably not be paid for this work, the advertising is invaluable. It is advertising without the stigma of advertising.

That raises the question of whether or not to advertise in newspapers or elsewhere, that is, paid, public advertising. I do not recommend it. It is expensive and may actually reduce your credibility. If your advertisement is positioned next to that of a local astrologer, a hypnotist, or a computer dating service, you may invite the wrong kind of attention. The best advertising is word-of-mouth, the personal reference. Use the business card provided by your academic institution (you will probably have to pay for it) and distribute it sparingly. Do not project a "slick" image. Such an image contradicts basic assumptions that most people have about English teachers. While we must improve our <u>self</u>-image in order to work profitably outside of our field, we may still make good use of the public image we have. We need not dress at the height of fashion; that may even interfere with our credibility. We need not spend $300 on an impressive briefcase. We need not fly first-class. We may, if we wish, without suffering any diminution of our image in the outside world, travel economically and dress plainly.

On the other hand, we should adopt the same professional standards as our clients in business matters. For example, we should use the same format for correspondence. If the professionals you wish to work for send memoranda to one another, then send memoranda, not letters. Return telephone calls the instant you return to your office, not several days later. Send follow-up letters, if that is customary. Keep a precise time-sheet for all work that you do; bill promptly and specifically, providing exact times, dates, names, and the nature of the work you have done. Remember that as employees in a non-profit sector of the economy, we are not accustomed to thinking of minutes as economic units. Time is money in a "for-profit" organization. Your minutes as a consultant are correspondingly valuable.

If consulting work goes well, you may find that you have too much to do: your teaching and your "field work" outside the academic world may add up to an 80-hour week. Like any other professional, you should consider doing first the things that pay you best. Everyone else does. This obviously not a sufficient reason for grossly neglecting students; but, in these inflationary times with academic salaries as low as they are and will remain, we are justified in diverting some of our professional time and energy to work that pays well. After all, if your students do not receive all that you have to offer, in the classroom, perhaps they will, some years down the line, have to hire you as a consultant.

ASSUMING RESPONSIBILITY:

AN AFFECTIVE OBJECTIVE IN TEACHING TECHNICAL WRITING

J. C. Mathes
Department of Humanities
College of Engineering
The University of Michigan

The need for effective technical writing has become more urgent than ever before. Health, safety, and economic well-being depend on effective technical writing by professionals in industry as well as government. An effective test report in an automotive company can result in serious accidents among the public at large; it can result in costly recalls that jeopardize the economic health of the company as well. Effective technical writing requires writers to master a series of cognitive skills, and these form the objectives for our technical writing courses in industry as well as in college. Management strongly supports these objectives, and relies on teachers of technical writing to achieve them with their students and employees.

I have learned from management, however, the need for an additional objective in technical writing courses, an affective objective: the willingness to assume responsibility for one's report. Ineffective technical writing also can result from a writer's inability or unwillingness to assume responsibility in a report.

A professional writing a technical report often must assume the responsibility for the consequences of the report. This is a two-step process. First, the professional must formulate the conclusions and recommendations implicit in his or her technical analysis. Second, the professional must ensure that these are acted upon as necessary. Although to do so requires cognitive skills, assuming responsibility for a report primarily requires the writer to be willing to do so. This is an affective objective that should be introduced into technical writing courses in college and in industry.

I first developed an awareness and appreciation of this need when working with the Manager of Truck Testing and Development at an automotive proving grounds. Even if we had enabled all of his engineers to express themselves clearly and concisely in the appropriate rhetorical structures and formats and with the necessary technical material, it would not, it turned out, have been sufficient. We also needed to enable them to assume responsibility for their reports.

To this manager, assuming responsibility meant that his engineers must have the willingness and ability to formulate conclusions and recommendations.

That is, he wanted his engineers to report that:

> "The durability characteristics of the GN83 brake package are satisfactory" (a conclusion)

rather than that:

> "The GN83 brake package passed the DP488 durability test" (a result)

He furthermore wanted his engineers to report:

> "Release the GN83 brake package for the 14200 lb GVW QR 600 models" (a recommendation)

The abilities to formulate conclusions and recommendations are cognitive skills--and ones difficult to master--that we must teach professionals on the job. To teach these cognitive skills, however, we also must develop in professionals the willingness to assume responsibility: that is an affective objective. Many professionals are reluctant to expose themselves, and many assume that to do so it to be unobjective. Professionals, however, should be taught to make judgments when the communication situation calls for judgment. A test engineer who restricts herself to the statement, "the GN83 brake package passed the DP448 durability test," forces a supervisor or manager to interpret this result and formulate the organizationally relevant conclusion. Yet, the test engineer usually is in the best position to make those judgments. A result such as, "the brake package passed the durability test," does not necessarily imply that the package is "satisfactory" and should be "released." There have been situations where that has not been so, and recalls have been required.

The professional, in addition, must ensure that appropriate action is taken as well as be willing to make judgments. This is the second aspect of assuming responsibility, and is a matter of an appreciation of a need, again an affective objective.

The accident at Three Mile Island dramatically illustrates this need. Simply put, Three Mile Island was a technical communication failure. On September 24, 1977, an incident occured at the Davis-Besse nuclear plant that was strikingly similar to the incident at Three Mile Island. The operators mistakenly turned off the high pressure injection system and momentarily uncovered the core. Fortunately, however, Davis-Besse was operating at only 10% of power. On November 1, 1977, February 9, 1978, and February 16, 1978, three memos were sent within Babcock and Wilcox (the contractor who supplied the nuclear steam supply system for both Davis-Besse and Three Mile Island) that asserted that unless instructions were changed, the core of a nuclear plant could become uncovered and a meltdown become possible. This in fact is exactly what happened at Three Mile Island. During the hearings of the President's Commission on the Accident at Three Mile Island, Mr. Bert Dunn, Manager of the Emergency Core Cooling Systems Section at Babcock and Wilcox, who wrote the February 9 and 16, 1978, memos, said:

> "Had my instructions been followed at TMI II, we would not have had core damage; we would have had a minor incident."

Mr. Dunn recommended certain actions, but did not appreciate the need for follow-through to ensure that action was taken.

On August 3, 1978, Mr. Donald Hallman, Manager of the Plant Performance

Services Section of Babcock and Wilcox, wrote a memo to Mr. Bruce Karrasch, Manager of the Plant Integration Section at Babcock and Wilcox, to inform him of Mr. Dunn's recommendations and that, because the Nuclear Service Section had raised some questions, the recommendations had not been acted upon--although Mr. Dunn's memos "suggest the possibility of uncovering the core if present HPI [high pressure injection] policy is continued." Mr. Karrasch in fact had been on the distribution list for Mr. Dunn's memos, but testified about each that "my memory does not recall my reading the memorandum or taking action on it." Mr. Karrasch, however, did remember receiving Mr. Hallman's memo, but did "not recall reading it very carefully at the time" and "thinking that they were rather routine questions." He "placed a note on top of the memorandum to one of two people who report to me in Plant Integration, with a message to him to please follow up on this and take any action that you seem [sic] appropriate." Those persons were Eric Swanson and Arthur McBride. Again:

> MR. KANE: Do Mr. Swanson or Mr. McBride recall ever receiving this memorandum of August 3, 1978, from you?
> MR. KARRASCH: No, sir, they do not.

The August 3, 1978, memo from Mr. Hallman to Mr. Karrasch, in which Mr. Hallman stated that action had not yet been taken on Mr. Dunn's recommendation, also has Mr. Dunn on the distribution list. Mr. Dunn, however, testified he didn't receive it:

> COMMISSIONER LEWIS: Mr. Dunn, I'd just like to get something clear. When did you first become aware of the Hallman memorandum? Was that after Three Mile Island or earlier, the August memorandum?
> MR. DUNN: That was after Three Mile Island.

On March 28, 1979, the operators at Three Mile Island failed to activate the High Pressure Injection system in time; the core became uncovered and a partial meltdown occured. On April 4 and April 17, 1979, Babcock and Wilcox issued new instructions to the operators of its nuclear reactors. These instructions were those recommended by Mr. Bert Dunn in his memos of February 9, 1978, and February 16, 1978. As Mr. Dunn himself testified, "Had my instructions been followed at TMI II, we would not have had core damage; we would have had a minor incident."

Three Mile Island, then, was--perhaps primarily--a communication failure. As the testimony suggests, this certainly was inadvertent. An examination of the testimony and of the memoranda suggests that the communication failure to a significant extent resulted because these professionals were unaware of the need to ensure that appropriate action is taken. Throughout this year-and-a-half period they assumed that action was being taken, but none bothered to see that it was. Essentially, these professionals did not appreciate the need for them to assume that responsibility. The testimony makes clear that, had they appreciated that need, they not only would have been willing to do so, they would have done so.

These examples therefore illustrate how teachers of technical writing must establish affective objectives as well as skills objectives. They must

teach their students to be aware of and to be willing to assume the responsibility for their reports. Achieving this affective objective, in practice and especially on the job, is a precondition for achieving the skills objectives we traditionally have emphasized in our technical writing courses.

References

The automotive proving grounds reports are proprietary, so I have changed the test situation components and documentation information. Except for those changes in specific information, the quotations are literal.

The Three Mile Island references are, in order of presentation, Transcript of Proceedings, President's Commission on the Accident at Three Mile Island, Public Hearings: July 18, 1979, p. 144; July 18, 1979, Exhibit No. 5 (the other memos referred to are Exhibit No. 1, No. 3, No. 4, No. 9, and No. 10); July 19, 1979, p. 239; July 19, 1979, pp. 240-241; July 19, 1979, p. 241; July 18, 1979, p. 117; July 18, 1979, Exhibits No. 9 and No. 10.

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15. Supplementary Notes

+ Professor and Chair, Department of Humanities, The University of Michigan (Ann Arbor)
* Assistant Chief, Research Information Applications Division

16. Abstract

A compilation of papers from session A6 - Toward a History and Definition of Technical Writing, and session Ill - Business and Technical Writing in the Technological World: Implications for the Teacher and Consultant. The papers were presented at the 32nd annual convention of the Conference on College Composition and Communications, in Dallas, Texas on March 26-28, 1981.

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